610.5
B86
M49

Medical Library

BRITISH MEDICAL BULLETIN

Vol. 2 (1944) No. 2

PULMONARY DISEASE

SPECIAL CONTRIBUTIONS

MEDICAL AND SOCIAL ASPECTS OF PULMONARY DISEASE
by Dr. P. M. D'Arcy Hart ... 30

THE PRESENT POSITION OF CHEST SURGERY
by Mr. R. C. Brock ... 33

RECENT WORK ON THE ANATOMY OF THE BRONCHI: WITH A DIAGRAMMATIC SURVEY
by Dr. A. F. Foster-Carter ... 37

REVIEW OF SELECTED PAPERS

Applied Anatomy of the Lungs

Bronchial Anatomy and Lung Abscess: I & II ... 39
Bronchial Embolism, Posture, and Lung Abscess ... 39
The Interlobar Fissure of the Lungs ... 40

Experimental Lung Damage

Histology of the Isolated Perfused Lung ... 40
Healing of Experimental Lung Wounds ... 40

Dusts Causing Lung Disease

Lung Tumours in Mice and Men ... 41
Failure of Aluminium to prevent Experimental Silicosis ... 42
Radiological Appearances in Coal Miners' Pneumokoniosis ... 42

Diagnostic Microscopy in Pulmonary Tuberculosis and Carcinoma

Sputum Examination in the Diagnosis of Lung Carcinoma ... 42
Bacteriological Investigations in Mass Radiography ... 43
Laryngeal Swab Culture in Pulmonary Tuberculosis ... 43

Neoplasm and Cystic Disease of the Lung

Surgery of Bronchial Carcinoma ... 43
Early Diagnosis of Pulmonary Neoplasms ... 44
Cystic Disease of the Lung ... 44

Therapeutic and Traumatic Collapse of the Lung

Effect of Altitude on Pneumothorax ... 44
Observations on a Series of Cases of Internal Pneumonolysis ... 44
Pneumoperitoneum in Collapse Therapy ... 45

Surgical Treatment of Pulmonary Tuberculosis

Persistence and Closure of Pulmonary Cavities ... 45
Extrafascial Apicolysis with Thoracoplasty ... 45
Results of Thoracoplasty ... 46
Closed Suction Drainage of Tuberculous Cavities ... 46
Drainage of Tuberculous Cavities—Technique and Indications ... 47
Artificial Bronchial Occlusion ... 47

Chest Surgery in Wartime

War Injuries of the Chest ... 47
Early Treatment of Thoracic Injuries ... 47
Pathology of Closed Injuries of the Chest ... 47
Effect of Explosion Blast on the Lungs ... 48

Scope of Chest Surgery: Rehabilitation: Chest Radiography: Atypical Pneumonia

Scope of Modern Chest Surgery ... 48
Rehabilitation of the Chest Case ... 48
Chest Radiography in Coryza and Sinusitis ... 49
Post-operative Radiography ... 49
Mass Radiography in Women ... 50
Mass Radiography at a Mental Hospital ... 50
Primary Atypical Pneumonia ... 50

Tuberculosis in Children

Relation of Childhood Infection to Later Manifestations ... 51
A Hundred Cases of Tuberculosis in Children ... 51
Incidence of Tuberculosis in Children ... 51

Social and Statistical Aspects of Tuberculosis

Tuberculosis in Peace and War ... 52
The Comprehensive Attack on Pulmonary Tuberculosis ... 52
Effect of War in Interval between Notification and Death ... 52
Survival Rates in Pulmonary Tuberculosis ... 53
Tuberculosis in London ... 53

BOOKS, MEMORANDA, REPORTS ... 54

GUIDE TO THE JOURNALS ... 55

This Number is devoted to a survey of recent investigations on pulmonary disease and its treatment or prevention by medical, surgical and social measures.

Dr. P. D'Arcy Hart, who contributes the first article, has been a member of the scientific staff of the Medical Research Council since 1937, and was previously Assistant Physician to University College Hospital. He was in charge of the medical part of the Council's investigation into chronic pulmonary disease in South Wales coalminers from 1937 to 1941, and is Secretary of its Committee on Tuberculosis in Wartime. The Report of this Committee is discussed in his article. During the past year he has been medical director in a team carrying out a mass radiography survey for the Council in selected population groups.

Dr. Hart has also been responsible for, or collaborated in, work on the value of tuberculin tests in man; on tuberculosis and social conditions; on tuberculosis in medical students; and on the pigments formed by streptococci. He gave the Milroy Lectures, Royal College of Physicians, in 1937, on "Prevention of Pulmonary Tuberculosis among Adults in England in the Past and in the Future."

Mr. R. C. Brock, who contributes an article on thoracic surgery, received his early training in this subject at Barnes Hospital, St. Louis, U.S.A., in 1930–31 as Fellow in Surgery and Assistant Surgeon to Professor Evarts A. Graham (to whom the Royal College of Surgeons of England has recently awarded an honorary Fellowship). In 1931 he was also attached to the Chevalier Jackson bronchoscopic clinic at Jefferson Hospital, Philadelphia, as clinical assistant to Dr. Louis H. Clerf. In 1934 he was appointed consulting thoracic surgeon to the London County Council group of hospitals. He was appointed Assistant Surgeon to Guy's Hospital (where he is now Surgeon) and to the Brompton Hospital in 1936. The Brompton Hospital has been responsible for much pioneer work in thorucic surgery and is recognised as one of the leading chest surgery centres in the world. Its four surgeons perform over 1,000 chest operations there each year.

Mr. Brock is at present also one of a team at a special surgical chest unit in a large Emergency Medical Service Hospital which deals with wounded military and civilian patients, and certain classes of ordinary military and civilian surgical chest cases.

Dr. A. F. Foster-Carter, who contributes summaries in text and diagram, according to the most recent observations, of the anatomy of the bronchial tree and pulmonary segments, has been Resident Medical Officer at the Brompton Hospital since 1938. During the past 5 years he has been carrying out investigations on the anatomy of the lungs, and he has also published original observations on bronchial adenoma.

This Number contains two new sections, which will appear regularly in future. The first—"Books, Memoranda, Reports"—consists of short notes on medical publications not classified as periodicals. The second—"Guide to the Journals"—lists titles and authors of papers on clinical medicine and the medical sciences published in the United Kingdom. Many of the papers listed will subsequently be reviewed in the Bulletin.

It is hoped that these two new sections will serve to give the Bulletin a comprehensive character which it previously lacked.

SPECIAL CONTRIBUTIONS

MEDICAL AND SOCIAL ASPECTS OF PULMONARY DISEASE

P. M. D'ARCY HART, M.D., F.R.C.P.
Scientific Staff, Medical Research Council

The growing interest in the social aspects of medicine, which is evident in Great Britain, has been reflected in some inquiries, published since the war, upon pulmonary disease. Prominent among these, and one which owes its origin to the present conflict, is the Report of the Committee on Tuberculosis in Wartime (*Medical Research Council*, 1942a). The other major inquiry into the medical aspects of pulmonary diseases, published in Britain during the war, was begun several years before. This was a large-scale investigation by a team under the Committee on Industrial Pulmonary Disease of the *Medical Research Council*, on the problem of lung disease due to dust in the South Wales coal mines.

The Problem of Tuberculosis

The Committee on Tuberculosis in Wartime was set up by the *Medical Research Council* at the request of the Ministry of Health in order to inquire into the causes of the increase in tuberculosis, and to advise on remedies. It may be noted that in England and Wales the total tuberculosis deaths in 1941 exceeded the average of the years 1938 and 1939 by 3,000 (12 %), and that in Scotland the excess was 700 (20 %).

Findings and General Recommendations

The Report of the Committee emphasises as of primary importance the social background of tuberculosis, and the part probably played by the very complex, and in some respects radical, wartime alterations in national life in the rising tuberculosis mortality between 1939 and 1941. Some of these changes increased the risks of infection and others decreased the resisting power of the individual. Among them may be mentioned the black-out; overcrowding in homes due to destruction by bombing; movements of population due to evacuation; industrialisation of groups of persons not previously engaged in factory work; diminished resistance due to fatigue from long hours of work and travelling; and, in certain categories of persons, possible inadequate rations.

Some of these social factors operated in the last war (Greenwood & Tebb, 1919; Faber, 1938), but the present planned food policy has probably made nutritional deficiency a less serious factor, particularly in children. If anyone has suffered it is most likely, according to the Committee, to have been adults, who were probably inadequately supplied with milk during 1940–1941. Young adults, especially young women, constitute a group particularly susceptible to environmental factors, so far as tuberculosis is concerned (Hart & Wright, 1939). In accordance with this analysis of social factors, the Committee recommends as of first importance "that continued watchfulness should be maintained upon the working conditions of young employees, particularly in regard to hours of work, transport difficulties, rest periods, factory canteens and hostel arrangements, and their relation to sickness absence."

Special Recommendations

The Committee's special recommendations, most of which have also strong social implications, fall under three main headings:

i. *Mass radiography.* Routine mass radiography is recommended with the double purpose (*a*) of detecting cases of tuberculosis in an earlier stage than has hitherto been achieved through the ordinary patient-doctor relationship, and placing them under treatment, and (*b*) of discovering unsuspected human sources of infection and removing them to safer surroundings for the benefit of the community as well as of themselves. The Committee advocates the use of the miniature method on which Abreu of Brazil did the pioneer work (Abreu, 1936, 1938, 1939), and which was further developed in various countries (Barros Barreto, 1937; Mazzei, 1937; Paula, 1938; Holfelder & Berner, 1938; Fournié & Frezouls, 1939; Berner, 1939; Ronneaux, 1939; Clark, Cordiner & Ellmann, 1941; Clark, Poulsson & Gage, 1941; Stanford, 1941; Stanford & Clark, 1942).[1] This method has proved successful during the present war in the Royal Navy (Dudley, 1941; Fitzpatrick, 1941; Brooks, 1943), in the Royal Air Force (Trail, 1942a, 1942b; Trenchard, 1943; Evans, 1943; Clive, 1943) and in the Australian Imperial Force (Cooper, 1940; Galbraith, 1941; White, 1941).

[1] [*For fuller literature up to the war, see Bentley & Leitner*, 1940.]

The Committee suggests that during the war priority should be given to groups in which young adults, particularly young women, are prominent, *e.g.* employees of war factories, nurses and medical students, merchant seamen. It is indicated that although the " diagnostic sweep " of a single mass radiography survey of a particular group will be useful, regular repetitions of such a procedure should in peace time be regarded as the best means of controlling the disease (Reid, 1940, 1941 ; Sawyer, 1941).

ii. *Financial provisions.* In Great Britain persons insured under National Health Insurance receive, when sick, a small weekly payment to help them during short periods of illness. This insurance was never intended to provide for the full support of sufferers from long-term illness requiring prolonged treatment, such as tuberculosis. Such persons, the Committee points out, often reach a very difficult economic position just when their needs are greatest ; the result is too often a premature return to work, with consequent danger of relapse and of spread of the disease to others. The Committee recognises the very great importance of maintaining the standard of living of the tuberculous patient, both from the standpoint of helping in the conquest of his disease, and from that of enabling his family contacts to maintain their resistance, so reducing the chances of development of the disease among them. The Committee also realises that organisers of mass radiography will encounter the difficulty of persuading persons with tuberculosis, who may feel fairly well, to leave their work for treatment, because of the financial difficulties involved. To meet the special characteristics of tuberculosis the Committee recommends that a special money allowance be made for a definite period, *e.g.* one year at least, to all persons leaving work because of this disease, the amount to depend upon the needs of the patient and his family. This financial scheme, it is suggested, might be linked with a fund for providing payments to supplement, to their full amount, the wages of those returning to their employment on a part-time basis (see below).

iii. *Rehabilitation.* The tuberculous person, after he has reached convalescence (or, if a chronic case, the limit of benefit from treatment), is usually left to his own resources. He may fail to obtain work within his capacity and so be lost as a useful citizen ; or he may plunge straight into full-time work, possibly of an unsuitable nature, and relapse. The Committee regards rehabilitation as an essential part of the treatment of tuberculosis, and suggests that arrangements should be made for the gradual return to industry of such persons on a basis of part-time or modified work. In considering the practicability of various kinds of re-employment, experience of different countries in this problem is drawn upon, *e.g.* that of Great Britain in Village Settlements, such as Papworth and Preston Hall, that of the U.S.A. in Municipal Work-Shop Schemes (Joint Tuberculosis Council, 1942), and that of the U.S.S.R. in methods of employment in normal industry (Vredenskaya, 1938, 1940 ; Gaft & Kalinin, 1940 ; Torkanovsky, 1940 ; Berenson, 1941 ; *British Medical Journal*, 1943). For the convalescent case in which cure is expected, it is suggested that a period of part-time ordinary work prior to resumption of full work will be adequate. On the other hand, in the chronic and perhaps infective cases, modifications or radical alterations in work may be required over long periods, and various types of collective arrangements to this end are outlined in some detail. Whether the work during rehabilitation be part-time or modified, or both, a financial supplement to wages is recommended in order that an adequate standard of living can be maintained by the patient and his family.

In scope and character this report goes far beyond proposals to deal with a wartime emergency. Indeed it represents an effort to obtain re-orientation of the attitude in Britain to the whole tuberculosis problem. This is to be achieved by a close integration of the social with the scientific medical approach.

Practical Measures

The Ministry of Health has responded by promptly implementing some of the main recommendations of the report. Thus, in December, 1942, the Minister announced (Circular 2741) that transportable miniature radiography sets, in accordance with a specification approved by the Committee's experts, would be made available for the use of a limited number of local authorities, the limits being set by the restrictions of war conditions on production and staffing. These sets have been produced during 1943 and, at the time of writing, about half a dozen large local authorities have received them and at least 3 have commenced operations. A team under the *Medical Research Council* has meantime been carrying out field trials with one of the sets, and has surveyed employees of two large factories, the staff of a number of Government Departments, and the staff and patients of a large mental hospital ; the results will be published shortly.

In April, 1943, the Ministry of Health issued a Memorandum (266/T) setting out a scheme for financial allowances for certain categories of persons leaving work to undergo treatment for tuberculosis. This scheme is now in general operation by local authorities, whose expenditure will be reimbursed by the State. It is expected that this scheme will be incorporated into any future scheme of social security of a general nature. Unfortunately it has not been possible to include any but pulmonary cases with good prospects of cure ; non-pulmonary cases and the very large number of chronic pulmonary cases are excluded. Furthermore, the majority of wives in employment are excluded, whatever the type of their disease. An interesting feature of the scheme is that persons granted the financial allowances can continue to receive these, though on a reduced basis, if they have a period of part-time employment after treatment.

Allowances during part-time employment will probably prove to be one factor in promoting satisfactory restoration of the tuberculous to work. In addition, some at least of the recommendations of the Committee regarding more definitive arrangements for providing suitable work in normal industry or in special industries, with or without previous vocational training, are expected to find their implementation in the Disabled Persons (Employment) Bill now passing through Parliament.

In conclusion it may be stated that in 1942 there was a check in the wartime increase of tuberculosis mortality in Great Britain, though the number of new cases showed a further slight increase. The official view is wisely one of continued watchfulness and of warning against complacency, for in the last war a similar pause was followed by a resumption in the increase of tuberculosis deaths. The new developments discussed above should be of service in offsetting any tendency to deterioration, as well as in the long-term attack on this disease.

Industrial Pulmonary Disease

Reference was made in the opening paragraphs of this article to a comprehensive long-term investigation by a team appointed by the Committee on Industrial Pulmonary Disease of the *Medical Research Council*. The situation calling for such an investigation may briefly be summarised as follows: The number of miners certified as having silicosis for compensation purposes had been increasing yearly in South Wales relative to the whole country, and this increase was most marked in the anthracite area in the West ; thus for the period 1931–37 the average annual number of new cases of certified silicosis per 1,000 underground workers was 5·23 in anthracite and 0·99 in non-anthracite mines in South Wales, as compared with 0·06 in coal mines in Great Britain excluding South Wales. Furthermore, it was believed by local doctors, as well as by the miners themselves, that other disabling conditions were being caused by dust besides that which was recognised as " silicosis " for compensation purposes.

Scope of the Investigation

The *Medical Research Council* inquiry was medical, including post-mortem studies, and environmental (*Medical Research Council*, 1942b, 1943). The medical inquiry was based upon a detailed examination of the men working at one colliery and on the more restricted examination of a selection of those in 15 other mines in South Wales, as well as a number of loaders of coal at 4 coal-shipping ports ; a detailed study of 42 selected necropsy cases constituted the pathological part of this inquiry. The environmental survey dealt with the examination of the concentration, particle-size and chemical nature of the air-borne dust breathed by the collier at the coal face, the composition and characteristics of the strata from which the dust was derived, the temperature and humidity of the air, and the concentration of nitrous fumes derived from explosives ; the mines studied were selected from those which formed the basis of the medical inquiry.

Summary of Medical Findings

The more important additions to knowledge resulting from the medical studies may be summarised:

i. *Description and classification of pulmonary changes.* A full description of the various pulmonary changes found is given, illustrated by photographs, and *x*-ray and pathological classifications are suggested. Tribute is paid to earlier classifications of coal miner's lung disease in Great Britain (*e.g.* Amor & Evans, 1934; Cummins, 1936; Cummins & Sladden, 1930), U.S.A. (*e.g.* Pancoast & Pendergrass, 1926; Bloomfield *et al.*, 1935), U.S.S.R. (Moshkovsky, 1941), Sweden (Edling, 1926) and other countries.

ii. *Topographical distribution of pulmonary abnormality.* The pulmonary abnormality encountered amongst South Wales coal miners is not restricted to the anthracite area, but can be found in the whole of this coal field. Its incidence and severity are greatest, however, among colliers who have worked for long periods at the coal face in the anthracite mines. Indeed, as indicated by recent coal mining compensation statistics, the main problem numerically in Wales is presented by the colliers, whereas in England the "hard-heading" workers (*i.e.* men who bore in rock) have been the main source of pulmonary trouble. This is not to say, of course, that such workers in South Wales coal mines escape, but there is not the same striking excess in the incidence over that in England.

iii. *Relationship between pulmonary abnormality and quality of coal.* A relationship is established between the incidence of pulmonary abnormality among the colliers, as judged by *x*-ray evidence, and the "rank" of the coal mined at the different collieries, though within the anthracite area there are also distinct local variations in incidence. The rank of coal in the South Wales coal field changes gradually from north-west, where the highest rank of anthracite is found, through the centre, where is the famous Welsh steam coal, to the south-east, where bituminous coal of the lowest rank in this field is situated. The incidence of pulmonary abnormalities among the colliers changes, broadly speaking, from high in the anthracite to low in the bituminous area, with a fairly gradual decrease between these two extremes. The presence of a low-incidence minority among the anthracite mines themselves appears to be associated with the presence of certain mines whose workings are relatively damp and shallow.

iv. "*Dust-reticulation.*" The types of pulmonary abnormality in South Wales coal miners include a form of disabling pulmonary disease, due to dust inhalation, which does not come within the accepted definition of "silicosis" as used for the purposes of the Workmen's Compensation schemes. This condition is here named "dust-reticulation," partly because the *x*-ray appearance is that of a network without nodules, and partly because its pathological basis is a reticular-tissue response (the two-fold relevance of the term reticulation being of course a coincidence). Reticulation probably represents the first of a series of pathological changes which may culminate in the gross fibrosis found so often at autopsy, the latter corresponding to nodular and conglomerate shadows on the radiograph. The incidence of disability in men showing reticulation alone tends to be less than in those with the more advanced pulmonary abnormalities; it falls mainly on men in the second half of life.

v. *Differences in dust-induced pulmonary disease.* Both dust-reticulation, and the more developed nodular and conglomerate radiographic changes also seen typically in colliers, differ in several important respects from the pulmonary abnormality found characteristically in "hard-heading" workers (see ii. above), which corresponds closely to the silicosis occurring in persons exposed to high concentrations of quartz.

vi. *Pulmonary abnormality in dock workers.* The pulmonary abnormality shown to occur in colliers is found also to some extent in coal "trimmers" (*i.e.* coal boat loaders) working at the docks in South Wales, and among these may also give rise to disability which may prove fatal.

The report provides a full review of previous published work on lung disease due to dust in coal workers. It is interesting to note that the excess of trouble in anthracite mines over bituminous mines is not confined to South Wales but has been reported in cotemporaneous investigations made both in the U.S.A. and U.S.S.R.

Summary of Environmental Findings

The principal findings of the environmental studies are as follows:

i. *Dust concentration and incidence of disease.* The incidence of pulmonary *x*-ray abnormalities among colliers at the different mines studied is positively correlated with the average concentration both of the coal and of the non-coal parts of the air-borne dust at the coal face, particularly as regards particles below 5 microns in size; this evidence confirms the generally accepted relation of the incidence of lung disease to the amount of dust inhaled.

ii. *Mineral analyses of dust and coal seams.* Chemical and *x*-ray diffraction analyses of the mineral matter in the coal seam and of the air-borne dust at the coal face are remarkable for their close similarity when derived from mines working widely differing ranks of coal. While the quartz amount varies, there is no clear relationship of this figure to rank of coal or to incidence of lung disease. Certain suggestive differences are, however, noted which may yield to deeper investigation, particularly if directed to the nature of silicates other than quartz in the coal seam.

iii. *Petrological studies.* Petrological examinations of the rock strata overlying the coal in different mines reveal a contrast between the shales in the anthracite and bituminous coal areas. Owing to the effects of compaction and metamorphism there are, in the anthracite area, an increase in the content of secondary quartz and mica, and a differentiation in the "ground mass," or ultimate cement substance, of the shale. Hydrated ferric oxide and alumina, both of which depress the solubility of silica, are less evident in the shales of the anthracite area than in those of the bituminous area. Whether directly or indirectly, the incidence of pneumokoniosis appears to be associated with these geological changes brought about by pressure.

Thus, while these environmental findings throw some light on the causes of variations in incidence of lung disease in different parts of the coal field, the striking relationship of the latter to the rank of the coals mined remains obscure and awaits further research.

Recommendations

From the practical standpoint the most important features of these inquiries lie in the recommendations of the Committee on Industrial Pulmonary Disease.

i. *Nomenclature.* The Committee recommends that the comprehensive term "pneumokoniosis of coal workers" should be used in future to cover "all the pulmonary conditions described as due to dust in workers engaged in any operation underground in coal mines, in screens workers at collieries and in coal trimmers at docks." This nomenclature is now being generally adopted in Great Britain.

ii. *Extensions of eligibility for compensation.* As dust-reticulation is clearly attributable to the industrial hazard and leads to some degree of disability, it is recommended that the diagnostic criteria required for purposes of compensation should be widened in scope, so as to include not only the more fully developed lung changes—as has hitherto been the case—but those established by the medical survey as comprising all the various stages of "pneumokoniosis of coal workers." The Workmen's Compensation Act (1943) embodies this suggestion, and in the summer of 1943 compensation began to be paid to miners with reticulation as well as to those with other forms of pneumokoniosis. Legislation to compensate coal trimmers, too (hitherto outside any scheme), may be expected in the near future.

iii. *Reduction of hazard.* The Committee makes certain recommendations for reducing the hazard in coal mines, particularly anthracite. These include: (*a*) improvement of ventilation; (*b*) all processes involving working in stone at the coal face to be carried out when the colliers are away; (*c*) shot-firing also to be carried out at a time when as few men as possible are present; (*d*) systematic use of water for dust-suppression to be exploited as fully as possible. Interesting developments can already be reported with regard to the last of these recommendations. Within recent months a method of infusing water into the coal face under pressure, before the coal is worked, has been introduced into certain mines in South Wales (Jenkins, 1943). The early results, which indicate a substantial reduction in the amount of dust produced, are promising, and further developments are eagerly awaited.

As with the tuberculosis report, the results of the pneumokoniosis inquiry should be felt for many years. We may hope that progress will be stimulated in a number of directions, *e.g.*, in methods for the industrial rehabilitation and re-employment of men disabled by this intractable disease, in improved diagnosis by periodic mass radiography coupled with physiological tests, in further methods for assessing the dust hazard and for suppressing the dust at the point of origin, and, indeed, in the general re-organisation of the national machinery for detecting and preventing industrial pulmonary disease among coal miners.

REFERENCES

Abreu, M. de (1936) [Communication to Medical & Surgical Society, Rio de Janeiro]
Abreu, M. de (1938) *Recenseamento torácico*, Pôrto Alegre
Abreu, M. de (1939) *Radiology*, **33**, 363
Amor, A. J. & Evans, R. G. P. (1934) *Practitioner*, **132**, 700
Barros Barreto, J. de (1937) [*Nat. Publ. Hlth. Dept. Report*], Rio de Janeiro
Bentley, F. J. & Leitner, Z. A. (1940) *Brit. med. J.* **1**, 879
Berenson, Y. E. (1941) *Probl. Tuberk.* No. 2
Berner, F. (1939) *Röntgenpraxis*, **11**, 65
Bloomfield, J. J., Dallavalle, J. M., Jones, R. R., Dreessen, W. C., Brundage, D. K. & Britten, R. H. (1935) Anthracosilicosis in hard coal miners, *U.S. Publ. Hlth. Bull.* No. 221, Washington
British Medical Journal (1943) **2**, 652
Brooks, W. D. W. (1943) *Proc. roy. Soc. Med.* **36**, 155
Clark, K. C., Cordiner, G. R. Mather & Ellman, P. (1941) *Brit. J. Radiol.* **14**, 54
Clark, K. C., Poulsson, K. T. & Gage, H. Courtney (1941) *Brit. J. Radiol.* **14**, 250
Clive, F. T. (1943) *Tubercle*, Lond. **24**, 63
Cooper, E. L. (1940) *Brit. med. J.* **2**, 245
Cummins, S. Lyle (1936) *J. Hyg., Camb.* **36**, 547
Cummins, S. Lyle & Sladden, A. F. S. (1930) *J. Path. Bact.* **33**, 1095
Douglas, B. H., Birkelo, C. C., Harmon, G. E. & Vaughan, N. F. (1940) *Amer. J. Publ. Hlth.* **30**, 1427
Dudley, S. F. (1941) *Proc. roy. Soc. Med.* **34**, 401
Edling, L. (1926) *Acta radiol.* **6**, 369
Evans, A. G. (1943) *Brit. med. J.* **1**, 565
Faber, K. (1938) *Acta tuberc. Scand.* **12**, 287
Fitzpatrick, W. G. C. (1941) *Proc. roy. Soc. Med.* **34**, 406
Fournié & Frezouls (1939) *Rev. de la Tuberc.* **5**, 795
Gaft, Y. M. & Kalinin, A. A. (1940) *Probl. Tuberk.* Nos. 2 & 3
Galbraith, D. (1941) *Brit. med. J.* **1**, 699
Greenwood, M. & Tebb, A. E. (1919) Med. Res. Comm. *Spec. Rep. Series*, No. 22, London
Hart, P. D'Arcy & Wright, G. Payling (1939) *Tuberculosis and social conditions in England*, Nat. Ass. Prev. Tuberc. London
Holfelder, H. & Berner F. (1938) *Münch. med. Wschr.* **85**, 1818
Jenkins, P. T. (1943) *Proc. S. Wales Inst. Engrs.* **59**, 306
Joint Tuberculosis Council (1942) *Tubercle*, **23**, 1, 25
Mazzei, E. S. (1937) *Dia méd.* 37
Medical Research Council (1942a) Report of the Committee on Tuberculosis in Wartime, *Spec. Rep. Series*, No. 246, London
Medical Research Council (1942b) Chronic pulmonary disease in South Wales coalminers: I. Medical Studies—A. Report by the Committee on Industrial Pulmonary Disease; B. Medical Survey by P. D'Arcy Hart & E. A. Aslett; C. Pathological Report by T. H. Belt & A. A. Ferris, *Spec. Rep. Series*, No. 243, London
Medical Research Council (1943) Chronic pulmonary disease in South Wales coalminers: II. Environmental studies—A. Report by the Committee; B.–G. Reports on physical, chemical and petrological studies, by T. Bedford & C. G. Warner; H. V. A. Briscoe, P. F. Holt, N. Spoor & others; G. Nagelschmidt; A. Brammall & J. G. C. Leech; D. Hicks & G. Nagelschmidt; J. Ivon Graham & D. F. Runnicles, *Spec. Rep. Series*, No. 244, London
Moshkovsky, I. I. (1941) *Tuberculosis and pneumokoniosis among underground workers, U.S.S.R.* State Publ. Dept. med. Lit., Moscow
Paula, A de (1938) *Rev. Tuberc. Uruguay*, **7**, 129
Pancoast, H. K. & Pendergrass, E. P. (1926) *Pneumoconiosis*, New York
Reid, A. C. (1940) *J. Indust. Hyg. & Toxicol.* **22**, 303, 408
Reid, A. C. (1941) *J. Indust. Hyg. & Toxicol.* **23**, 35
Ronneaux, G. (1939) *Bull. Acad. Méd. Paris*, **121**, 136
Sawyer, W. A. (1941) *Symposium on tuberculosis in industry, Saranac Lab., Nat. Tuberc. Ass.* New York, p. 311
Stanford, G. B. (1941) *Brit. J. Radiol.* **14**, 128
Stanford, G. B. & Clark, K. C. (1942) *Lancet*, **2**, 216
Torkanovsky, P. B. (1940) *Probl. Tuberk.* Nos. 2 & 3
Trail, R. R. (1942a) *Lancet*, **1**, 609
Trail, R. R. (1942b) *Lancet*, **2**, 413
Trenchard, H. J. (1943) *Lancet*, **1**, 366
Vredenskaya, N. E. (1938) *Probl. Tuberk.* No. 6
Vredenskaya, N. E. (1940) *Probl. Tuberk.* No. 10
White, B. (1941) *Med. J. Austr.* **2**, 23

244

THE PRESENT POSITION OF THORACIC SURGERY

R. C. BROCK, M.S., F.R.C.S.

Consultant Thoracic Surgeon, London County Council

Surgeon, Guy's Hospital and Assistant Surgeon to the Brompton Hospital, London

Before the war of 1914–18 very little thoracic surgery was being done except by a few bold pioneers, but the experience gained in the treatment of severe chest wounds served as a great impetus for its development. The influenza epidemics of 1917 and 1918 also led to big advances in the treatment of empyema and of lung-suppuration. The last 10 years in particular have seen the surgery of the thorax both widely accepted and widely practised, the most notable development being lung resection; pneumonectomy and lobectomy to-day are standard procedures, whereas before 1930 they were operations of rarity and hazard.

The surgery of the thorax is akin to neuro-surgery in the special training needed for its proper practice. It is not enough for a surgeon just to perform operations upon the chest as if he were a carpenter. He must possess a wide knowledge of the medicine and pathology of intrathoracic diseases as well as of the anatomy and physiology of the chest; he must be an expert bronchoscopist, able to form his own opinion on diagnosis and treatment, and must not be guided entirely by his physician colleague. At the same time, close co-operation with a physician is essential for good work, and in no other disease is this so important as in pulmonary tuberculosis.

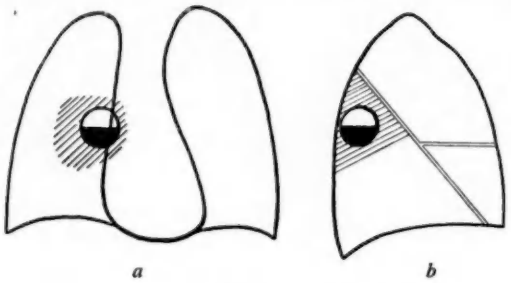
The medicine and surgery of any part of the body must rest, first of all, on a sound knowledge of anatomy. It is strange that until recently the anatomy of the bronchial tree has received but little attention, whereas a correct knowledge of the arrangement of the chief secondary bronchi is essential for a proper understanding of many lung diseases.

Lung Abscess and the Segmental Anatomy of the Lungs

Lung abscess has traditionally been treated conservatively, but the important part that surgery has to play in many examples of this serious condition is being increasingly recognised. A sound knowledge of the segmental anatomy of the lungs is essential both for prescribing correct postural drainage and for a correct and safe surgical approach for

open drainage. It is not satisfactory, in ordering postural drainage, just to tip the patient by raising the foot of the bed; as was pointed out by Nelson (1934), a different position is needed for a lesion of different broncho-pulmonary segments. For instance, a patient with an abscess of the apical part of the lower lobe should lie prone.

Neuhof & Touroff (1936, 1942) have made important contributions in a consecutive series of articles in which they stress the importance of early drainage of the acute fœtid abscess. These two surgeons have shown that all lung



a *b*

Diagram of abscess of the apical part of the right lower lobe. In the postero-anterior view (*a*) the appearance is that of a so-called "central" or hilar abscess. The lateral view (*b*) shows the true localisation, an abscess presenting on the visceral pleura at the periphery of the affected broncho-pulmonary segment.

abscesses approach the visceral pleura, the old conception of "central" and "peripheral" abscesses being false. This misconception has arisen from failure to use lateral radiographs, which are essential for the proper study of almost all lesions of the lungs and are indispensable in lung abscess. Early drainage of a lung abscess that is not showing prompt and steady response to conservative measures is associated with a low mortality and quick healing, with little or no residual damage to the lung. Delay for weeks, or even months, is most undesirable, for when operation is at last resorted to, the mortality is higher and permanent damage to the lung may be inevitable. In such cases lobectomy or even pneumonectomy may be needed.

The ætiology of lung abscess is important and closer study of cases has shown that the old conception of the abscess following "pneumonia" is not correct. It rarely if ever follows an acute specific pneumonia, but is usually caused by a non-specific pneumonitis following the inhalation of infected material from bad teeth or during anæsthesia. This observation receives strong support from a correlation between the segmental anatomy of the lung, the sites most favoured by lung abscess, and demonstration that these sites are also those favoured by inhaled material in certain standard postures (Brock, Hodgkiss & Jones, 1942).

Empyema: Importance of After-Treatment

Empyema has long been considered the one chest disease which could be safely treated by the general surgeon. Although its widespread and common occurrence often necessitates treatment by the non-specialist, its management may leave much to be desired when it is not in the hands of a thoracic expert. It is fair to say that scarcely any other condition is treated so indifferently; instead of healing rapidly with no permanent disability, large numbers of patients are chronic sufferers or subject to recurrences lasting many months or years, require several operations, and end with permanent disability and deformity. In the past the surgeon has been content to evacuate pus by drainage at some convenient site and to leave in the drainage tube for an empirically determined time such as 10–14 days. It is uncommon to find any care expended on early mobilisation of the patient or on earnest instruction in breathing and postural exercises designed to encourage lung expansion and to prevent deformity. The thoracic expert knows only too well, from bitter experience with the many chronic empyema cases that come to him for treatment, that the greatest care and thought must be given to the correct placing of the drainage hole and to careful watching of the size, shape and extent of the healing pleural cavity. The tube, which may need frequent and patient readjustment, must be retained until the infected pleural space has been shown to be obliterated by complete fusion of the visceral and parietal pleuræ; too early removal of the drainage tube before the space has obliterated is the most frequent cause of chronic empyema (Brock, 1941). Allison (1943) has recently written a useful survey of the management of these cases.

The recognition of the importance of breathing and postural exercises is one of the big advances made in the treatment of diseases of the chest in the last 10 years. Perhaps the most striking difference between the "professional" and "amateur" thoracic surgeon is the use the former makes of this invaluable aid in the pre- and post-operative care of his patients. Unfortunately a chronic empyema still implies thoracoplasty to many surgeons, but most patients can be spared this further mutilation if proper drainage is instituted and maintained while vigorous physical treatment is given. Premature resort to the old mutilating Estlander and Schede operations is to be deplored. Only too often these operations are performed in cases in which the cause of the chronicity does not even lie in the pleura but in disease of the underlying lung, such as bronchiectasis, cystic disease, or growth. It is most important that every chronic empyema case should be completely investigated for the true primary cause of chronicity before treatment is decided (Brock, 1936).

Lobectomy and Pneumonectomy in Bronchiectasis

Bronchiectasis is a foul and loathsome disease causing much misery, suffering and death, and its surgical treatment was difficult and dangerous until the work of Brunn (1929) and of Shenstone & Janes (1932) gave us safe one-stage lobectomy with the tourniquet technique. Very soon large numbers of patients received the benefits of this operation, and in 1939 Tudor Edwards was able to publish his experiences in a series of 199 patients treated by lobectomy or pneumonectomy, the operative mortality being 12%. Among these cases were 38 children, aged 4–16, all of whom survived operation. Children tolerate lobectomy well and there can be no doubt that the disease is best treated in childhood if it is recognised then, for in addition to the low mortality from operation, the patient is spared the dangers and drawbacks of carrying his disease into adult life, often with stunting of stature and loss of much useful time from school or work. Churchill (1937) has also published a striking series of 49 cases in which the mortality was 6·1%, the last 30 consecutive cases being completed without a death.

Pneumonectomy soon followed lobectomy for bronchiectasis, the first operations being performed by Nissen (1931) in Germany and Haight (1934) in America. In Britain, Tudor Edwards and Roberts performed the first pneumonectomies for bronchiectasis by a one-stage operation in contrast to the two-stage procedure used by Nissen and Haight. The one-stage operation is now universally accepted.

The earlier tourniquet technique for removal of a lobe or a lung was of great value in establishing the operation, but for some years now it has given way to removal by dissection and ligation of the main vessels and bronchus, a procedure much more in keeping with sound surgical principles. Blades & Kent (1940) have written on the anatomy of the lobar vessels, as displayed at the dissection operation. Tudor Edwards originally performed a one-stage lobectomy for bronchiectasis by the individual ligation technique as long ago as 1929; this was the first successful case of its kind in Britain. Lobectomy has also been applied with great success to selected cases of bilateral disease and, finally, with the greater confidence that has followed knowledge of the anatomy of the broncho-pulmonary segments, even segmental resection of lobes has been successfully used.

The disability following lobectomy and pneumonectomy is usually small or non-existent. Greater disability may occur after pneumonectomy for carcinoma in an elderly patient, but even then any ordinary occupation can be followed. A successful lobectomy in a young patient should give rise to no disability whatever and many such patients are on full active duties in each of the fighting services to-day.

Surgery and Pulmonary Tuberculosis

The surgical treatment of pulmonary tuberculosis is a vast and increasing field of work. Some of the earliest pioneer work in the surgery of the chest rose from the treatment of this disease, and much steady progress has been made over many years. The problem has many important sociological and administrative bearings, apart from the pure surgical considerations, or more correctly, arising out of the success of surgical interference. Pulmonary tuberculosis remains a

great scourge in spite of its lessened incidence during this century and its victims are mostly young people. Apart from physical suffering and death, it brings with it much misery, deprivation and want, affecting the sufferer's family as well. Routine medical and sanatorium treatment play an invaluable and irreplaceable part, but far too many patients relapse afterwards and, as many reports have shown, of those who have a positive sputum at the end of sanatorium treatment some 75 % are dead within 3 years. Thompson (1943) has recently described an investigation of 406 adult patients followed for from 5–15 years in which the poor outlook for the patient with a cavity is emphasised. Thus, he found that 64 % were dead within 3 years and 75 % in 5 years.

There is much wastage from the policy of " patching-up " the patient with several months in a sanatorium and then sending him back to work, outwardly well, but inwardly still with uncontrolled, albeit temporarily silent, disease. The help of surgery is often requested only when years of chronic disease have had their effect. Many of the patients occupying the surgeon's time should have been operated upon two, three or more years before, and many others in the ideal phase for surgery are being sent back to work instead of to the surgeon. Village Settlements, such as *Papworth*, can play a useful part in the rehabilitation of a certain number of patients.

It is for this reason that the field of surgery in the treatment of pulmonary tuberculosis is potentially such a vast one, and will require considerable, preferably national, organisation to make it available for all who can benefit from it. If the number of sputum-positive cases sent back to their homes or to industry could be diminished, this alone would lessen the number of new cases.

The surgery of pulmonary tuberculosis is related chiefly to " collapse therapy," and in its simplest form begins with artificial pneumothorax. Air introduced into the pleura has itself no healing effect ; it benefits the patient only when it enables the diseased part of the lung to relax. For this reason it is inevitable that thoracoscopic division of adhesions limiting collapse of the lung must play a very important part in treatment. This operation, performed skilfully, carries a low morbidity and mortality. Barclay (1943) has recently written of his experiences in 80 cases ; previously Chandler (1937) has recorded his experiences in 210 operations, and Brock (1938a) has written of his results in 442 operations with the low incidence of 5 cases of simple tuberculous empyema and 5 cases of empyema with mixed infection—many times lower than that of artificial pneumothorax cases left with adhesions undivided. In other words, the incidence of complications is lessened by cauterisation of adhesions. The last of the papers mentioned above also contains a complete account of the technique of the operation and a practical consideration of the structure of adhesions. Just as every sanatorium or hospital treating phthisis should be equipped for pneumothorax treatment, so should it have facilities for division of adhesions in suitable cases.

A few years ago extrapleural pneumothorax had a phase of great popularity (Roberts, 1938 ; Brock, 1938b ; Sellors, 1938), but to-day it is seldom used. It is an operation of value in a few carefully selected cases, chiefly in children below 16 years of age, and in older patients with an acute lesion unlikely to be controlled by rest alone, and in whom an ordinary pneumothorax has failed. The operation has a mortality (10 %) and a morbidity too high for general use ; only about one-half of the patients derive substantial benefit from it, and this is too low a figure for an operation of election. If the patient is fit for a thoracoplasty, or is likely to become fit enough after a proper period of rest, then extrapleural pneumothorax should never be used in its place.

Thoracoplasty is a good operation with a relatively low mortality and morbidity and gives a high percentage of permanent cures. As stated above, if it could be used more often on earlier cases, the results would be even better.

Until some 6–7 years ago thoracoplasty consisted essentially of resection of the ribs, a method which gave only lateral compression of the lung. In 1935 Semb, following on the work of his senior Holst, introduced extrafascial apicolysis by which the diseased part of the lung is mobilised by deliberate and careful dissection so as to give the concentric relaxation and collapse that can otherwise be obtained by a perfect artificial pneumothorax (Semb, 1935, 1937). Semb's operation is now almost universally accepted and practised and is a great advance in the surgical attack on phthisis. Thomas & Cleland (1942, 1943) have recently written fully of their experiences with the operation and of their results.

Overholt (1941) has recorded the results of his team in which the mortality from operation in 874 patients (a total of 1898 operations) was only 5·3 %, and 5 years or more later 94 % of the patients were alive and well, with the disease arrested ; 83 % were working.

The importance of submitting suitable patients for operation early and not delaying until the " slipping chronic " stage has been reached is emphasised by Freedlander & Wolpaw (1937), who compared the results of operation upon 85 patients with a control group of 58 patients who refused operation. Thoracoplasty gave good results in 75 % of the " good chronic " cases and in only 57 % of the " slipping chronic " group. Hurford (1941) in a similar but smaller investigation found that of 54 unfavourable cases, 65 % were satisfactory after at least one year, whereas of 44 controls who had refused operation, 45 % were dead ; of the thoracoplasty patients surviving, 64 % were working.

While collapse therapy is the essence of the surgical treatment of pulmonary tuberculosis, cases still remain in which a cavity in the lung does not respond to the standard measures. The problem of the mechanism of the production of cavities has stimulated much investigation (Coryllos, 1936 ; Coryllos & Ornstein, 1938 ; Goldman, Brunn & Ackerman, 1941 ; Thomas, 1942), but the name of Monaldi (1939) is particularly associated with the proposal of treating a certain type of " distension " cavity by constant gentle suction through an indwelling catheter used for drainage. The method has taught us much of the physiology and pathology of cavities but has been disappointing in its results. Like extrapleural pneumothorax, it has a very limited application, chiefly for a few early or bilateral cases. Sellors (1942) finds that thoracoplasty is still needed in most of the patients on whom it is used. Maxwell & Kohnstamm (1943) also find the end-results disappointing. Both the last-named papers contain much valuable information on the technique and management of the treatment of cavities by the Monaldi method.

The chief difficulty in the way of permanent closure of the cavity seems to be persistence of the bronchial fistula. If it were possible to close the bronchus safely and easily it would be a big advance. Thomas, Gough & Still (1943) describe the use of plasma-clot for this purpose and show that there is a field for investigation into similar methods.

Pneumonectomy in Bronchial Carcinoma

The most striking advance in the surgery of the chest during recent years lies, undoubtedly, in the attack on bronchial carcinoma. Scarcely 10 years ago a diagnosis of bronchial carcinoma was the equivalent of a death-sentence, for the only form of treatment then available, deep *x*-ray therapy, has probably never cured a genuine case of the disease. The success attending lobectomy for bronchiectasis led to the use of the operation for favourable cases of carcinoma, but with only limited success, for the number of cases which could be treated in this way was small and the recurrence rate was high. In 1933, however, Graham was able to report his dramatically successful case of one-stage pneumonectomy for carcinoma ; the patient, a physician, was still alive and well more than 10 years after. This operation was a modified tourniquet resection, but later in the same year Rienhoff performed the first pneumonectomy by dissection, and since then he and Overholt have published numerous papers on their experiences. Dissection pneumonectomy with removal of the adjacent mediastinal glands has now become the accepted standard surgical procedure for operable cases of bronchial carcinoma and is an operation based on those same sound principles which have proved so successful in the surgical treatment of carcinoma of the breast and colon. Overholt (1940) in a survey of his own series and 58 from a special questionnaire has shown that the results are promising, that they are far better than those of deep *x*-ray therapy or of any other method of treatment, and have fully justified the operation. In this country Brock (1943) has recently published an account of his experiences in which the operability rate in 187 consecutive cases was 8 %, and of his results in radical removal in 29 patients.

The main problem to be solved in pneumonectomy is successful primary healing of the divided bronchus. This still causes great difficulties, but much useful experimental

and clinical work has been published on it (*e.g.* Rienhoff *et al.*, 1942). Brock has obtained good results by the use of a pedicled intercostal muscle graft for the closure, but his work has not yet been published. It is probable that no method will ever ensure primary closure in every case, just as it is at present impossible to ensure primary healing of all wounds in the body. Sepsis is present in many cases of pneumonectomy, and breaking-down of the suture line is inevitable at times. Nevertheless there is still room for improvement, and few will contest that a great impediment to smooth and easy convalescence will be removed when the problem of the safest method of bronchial closure is solved.

Radiology and Anæsthesia : Future of Thoracic Surgery

The present firm position of thoracic surgery rests on two other things, besides its intrinsic strength ; these are radiology and anæsthesia. Without radiology no precision would be possible and no decision would be safe. Until Roentgen's discovery the time was not ripe for the development of thoracic surgery, especially the surgery of pulmonary tuberculosis. The invaluable part played by radiology in the complex post-operative care is ably surveyed and illustrated by Cleland & Rackow (1943).

No thoracic surgeon would deny to the modern anæsthetist full acknowledgment of the invaluable part played by him in the success of the severe and formidable operations of pneumonectomy, lobectomy, thoracoplasty, and thoracotomy for the removal of mediastinal tumours. While the surgeon opens the chest and operates upon the viscera therein, often producing profound interference with their function, respiration and circulation must be maintained and the anæsthetist is faced with many problems in achieving this. Local anæsthesia has made thoracoplasty easier and safer; controlled respiration (Crafoord, 1938, 1940; Nosworthy, 1941) has done much to help open thoracotomy and lung-resection. Nosworthy in particular has written fully and clearly on the problems of anæsthesia in intrathoracic surgery. Just as thoracic surgery itself is still advancing, so its two able supporters, radiology and anæsthesia, are constantly improving.

Many difficult problems in connection with the lungs have been solved, problems which a few years ago seemed insoluble. Less great but none the less worthy progress is also being made in the surgery of those two other most difficult and resistant organs, the œsophagus and the heart. The next ten years will probably see just as great advances in the solution of their surgical problems as the last decade has seen in the surgery of diseases of the lungs.

BIBLIOGRAPHY

Allison, P. R. (1943) Management of acute pleural empyema. *Brit. med. J.* **2,** 383

[1] Barclay, R. S. (1943) Some observations on eighty consecutive cases of internal pneumonolysis. *Edinb. med. J.* **50,** 554

Blades, B. & Kent, E. M. (1940) Individual ligation technique for lower lobe lobectomy. *J. thorac. Surg.* **10,** 84

Brock, R. C. (1936) The principles governing the treatment of chronic empyema. *Guy's Hosp. Gaz.* **50,** 429

Brock, R. C. (1938a) Thoracoscopy and cauterisation of adhesions. *Brompton Hosp. Rep.* **7,** 81

Brock, R. C. (1938b) Extrapleural pneumothorax. *Brit. J. Tuberc.* **32,** 173

Brock, R. C. (1941) Drainage of the pleura. *Brit. med. J.* **2,** 128

[2] Brock, R. C. (1943) Surgical treatment of bronchial carcinoma. *Brit. med. J.* **2,** 257

[3] Brock, R. C., Hodgkiss, F. & Jones, H. O. (1942) Bronchial embolism and posture in relation to lung abscess. *Guy's Hosp. Rep.* **91,** 131

Brunn, H. (1929) Surgical principles underlying one-stage lobectomy. *Arch. Surg.* **18,** 490

Chandler, F. G. (1937) Internal pneumolysis: result of 210 consecutive operations. *Tubercle,* **18,** 298, 348

Churchill, E. D. (1937) Lobectomy and pneumonectomy in bronchiectasis and cystic disease. *J. thorac. Surg.* **6,** 286

[4] Cleland, W. P. & Rackow, A. M. (1943) Radiology in post-operative chest surgery. *Brit. J. Tuberc.* **37,** 55

Coryllos, P. N. (1936) Mechanics and biology of tuberculous cavities. *Amer. Rev. Tuberc.* **33,** 639

Coryllos, P. N. & Ornstein, G. G. (1938) Giant tuberculous cavities of the lung. *J. thorac. Surg.* **8,** 10

Crafoord, C. (1938) On the technique of pneumonectomy in man. *Acta Chir. Scand.* Suppl. 54.

Crafoord, C. (1940) Pulmonary ventilation and anesthesia in major chest surgery. *J. thorac. Surg.* **9,** 237

Edwards, A. T. (1939) Modern principles of treatment in bronchiectasis, based upon 199 cases treated by lobectomy or total pneumonectomy. *Brit. med. J.* **1,** 809

Freedlander, S. O. & Wolpaw, S. E. (1937) A control group for studying the end-results of thoracoplasty. *J. thorac. Surg.* **6,** 477

Goldman, A., Brunn, H. & Ackerman, L. (1941) Tuberculous cavities. *Amer. Rev. Tuberc.* **43,** 151

Graham, E. A. & Singer, J. J. (1933) Successful removal of entire lung for carcinoma of the bronchus. *J. Amer. med. Ass.* **101,** 1371

Haight, C. (1934) Total removal of left lung for bronchiectasis. *Surg. Gynec. Obst.* **58,** 768

Hurford, J. V. (1941) Thoracoplasty for pulmonary tuberculosis. *Lancet,* **1,** 693

[5] Maxwell, R. J. C. & Kohnstamm, M. L. (1943) The transpleural drainage of tuberculous cavities. *Brit. J. Tuberc.* **37,** 24

Monaldi, V. (1939) L'aspirazione endocavitaria nella cura delle caverne tubercolari del polmone. *Sett. med.* **27,** 231

Nelson, H. P. (1934) Postural drainage of the lungs. *Brit. med. J.* **2,** 251

Neuhof, H. & Touroff, A. S. W. (1936) Acute putrid abscess of the lung. Principles of operative treatment. *Surg. Gynec. Obstet.* **63,** 353

Neuhof, H. & Touroff, A. S. W. (1942) Acute putrid abscess of the lung. *J. thorac. Surg.* **12,** 98

Nissen, R. (1931) Exstirpation eines ganzen Lungenflügels. *Zbl. f. Chir.* **58,** 3003

Nosworthy, M. D. (1941) Anæsthesia in chest surgery, with special reference to controlled respiration and cyclopropane. *Proc. roy. Soc. Med.* **34,** 479

Overholt, R. H. (1940) Curability of primary carcinoma of the lung. *Surg. Gynec. Obstet.* **70,** 479

Overholt, R. H. (1941) Permanent collapse therapy in pulmonary tuberculosis. *J. Amer. med. Ass.* **117,** 1681

Rienhoff, W. F., Gannon, J. & Sherman, I. (1942) Closure of the bronchus following total pneumonectomy. *Ann. Surg.* **116,** 481

Roberts, J. E. H. (1938) Extrapleural pneumothorax. *Brit. J. Tuberc.* **32,** 68

Sellors, T. H. (1938) Extrapleural pneumothorax. *Brit. J. Tuberc.* **32,** 182

[6] Sellors, T. H. (1942) Closed suction drainage of tuberculous cavities. *Tubercle,* **23,** 239

Semb, C. (1935) Thoracoplasty with extrafascial apicolysis. *Acta chir. Scand.* Suppl. 37

Semb, C. (1937) Thoracoplasty with extrafascial apicolysis. *Brit. med. J.* **2,** 650

Shenstone, N. B. & Janes, R. M. (1932) Experiences in pulmonary lobectomy. *Canad. med. Ass. J.* **27,** 138

[7] Thomas, C. P. (1942) Pulmonary cavities: their persistence and closure. *Brit. J. Tuberc.* **36,** 4

[8] Thomas, C. P. & Cleland, W. P. (1942) Extrafascial apicolysis with thoracoplasty. *Brit. J. Tuberc.* **36,** 109

[9] Thomas, C. P. & Cleland, W. P. (1943) Results of thoracoplasty. *Brit. J. Tuberc.* **37,** 2

[10] Thomas, D., Gough, J. & Still, B. M. (1943) Artificial bronchial occlusion by plasma clot. *Brit. J. Tuberc.* **37,** 44

[11] Thompson, B. C. (1943) Survival rates in pulmonary tuberculosis. *Brit. med. J.* **2,** 721

[1] [*see BMB* **263**] [2] [*see BMB* **259**] [3] [*see BMB* **249**] [4] [*see BMB* **278**]
[5] [*see BMB* **269**] [6] [*see BMB* **268**] [7] [*see BMB* **265**] [8] [*see BMB* **266**]
[9] [*see BMB* **267**] [10] [*see BMB* **270**] [11] [*see BMB* **288**]

RECENT WORK ON THE ANATOMY OF THE BRONCHI

A. F. FOSTER-CARTER, D.M., B.Ch.
Resident Medical Officer, Brompton Hospital, London

[This article should be read in conjunction with the diagrams on the next page]

Apart from the researches of a few workers at the end of the nineteenth century, notably Aeby (1880), William Ewart (1889), and Narath (1901), the anatomy of the bronchi received comparatively little attention until the last decade. The introduction of bronchoscopy, the development of chest radiography, particularly bronchography, and the advance of thoracic surgery have caused a revival of interest in bronchial anatomy, and many papers on this subject have now been published. Ewart was the first to notice that each branch-bronchus supplies a definite area of lung, and these areas have since been called the " broncho-pulmonary segments." In 1932, Nelson pointed out that the apex of the lower lobe could be regarded as a separate entity having its own bronchial and blood supply, and in the same year Kramer & Glass (1932) published a description of all the broncho-pulmonary segments. Later, Nelson (1934) gave a concise description of the distribution of the bronchi, which has been widely accepted.

Certain French workers have also published descriptions of the bronchi and segments, notably Grandgerard & Weber (1935) and Lucien & Weber (1936), and a summary of their researches has been given by Hovelacque, Monod & Evrard (1937). Churchill & Belsey (1939) described the anatomy of the " lingula " of the left upper lobe, and Neil, Gilmour & Gwynne (1939) have also given an account of the bronchi and segments. The surgical anatomy of the lung roots has been described by Hovelacque, Monod & Evrard (1937), and by Kent & Blades (1942), and those interested in the histology of the bronchi and lung should consult Miller (1937).

Foster-Carter (1942) has shown that previous accounts of bronchial anatomy contained certain inaccuracies and has given a detailed account of the bronchi with particular reference to those of the right upper lobe which were incorrectly portrayed in the past. More recently Brock (1942) has corroborated this description of the right upper lobe. The following account of the human bronchial tree is based on the study by the writer of celloidin casts, dissections, segmental injections, and bronchograms. The simplest possible names have been used, and the series of explanatory diagrams will help to make the description clear; the letters in square brackets refer to the diagrams.

It is convenient to regard the bronchial system in each lung as a stem with a series of branches, and there is sound embryological justification for this conception (Huntington, 1920). The first or eparterial branch of the right stem-bronchus [d] is directed laterally and supplies the right upper lobe. It divides into three branches, anterolateral or ventral [e], posterolateral or dorsal [f] and apical [g]. Many previous accounts have mentioned a fourth or " axillary " branch, but this does not normally exist in the human lung (Foster-Carter, 1942). The axillary area is supplied by lateral branches from the anterior and posterior divisions and not by a separate axillary branch. The apical bronchus also sends a branch to the upper part of the axillary area. The next branch of the right stem-bronchus, the middle bronchus [h], is directed forwards and supplies the right middle lobe; it has two principal divisions, lateral [k] and anterior [m].

In the left lung, the branch to the upper lobe combines the functions of the eparterial and middle bronchi on the right. The left upper lobe is equivalent to the right upper and middle lobes, and is sometimes subdivided by a fissure. The left upper bronchus [s], therefore, has two main divisions: the left ascending bronchus [u] and the left middle bronchus [t]. The ascending branch is equivalent to the eparterial bronchus on the right and has similar branches—anterolateral, posterolateral and apical—the last two arising by a common stem, which the writer has called the apico-posterior [v]. The left middle bronchus [t] supplies the lower part of the left upper lobe, which is equivalent to the right middle lobe and is often called the " lingula "; it has anterior [m] and lateral [k] divisions resembling those of the right middle bronchus.

The bronchi of the two lower lobes are similar and may be considered together. After the stem-bronchus enters the lower lobe, the first branch is the dorsal bronchus [n] directed backwards. This supplies the apex of the lower lobe, and its branches can extend outwards as far as the posterior axillary line and downwards as far as the 10th thoracic vertebra on the inner side. The next branch, the cardiac bronchus [o], is peculiar to the right lung; it arises from the medial aspect of the stem and supplies the medial part of the right lower lobe adjacent to the heart. A short distance further down, a large branch, the anterior basic [p], arises from the anterolateral aspect of the stem to supply the anterior part of the lower lobe. The stem-bronchus then appears to divide into two terminal branches, the lateral basic [q] and the posterior basic [r]. These supply the lateral and posterior parts of the lower lobe, and the posterior basic branch is actually the direct continuation of the stem-bronchus itself.

Figures 4 to 9 show the areas of lung (broncho-pulmonary segments) supplied by the branches described above. The size of each segment varies slightly in different lungs, but the segments, like the bronchi, are fairly constant in position. In this account, an attempt has been made to depict the most common arrangement of the bronchi and their segments, and this pattern, with very slight variations, will be found in the majority of instances.

It is necessary for both physician and surgeon to have a working knowledge of the bronchial tree and broncho-pulmonary segments upon which to base their diagnosis and treatment of thoracic disease. For instance, in the interpretation of bronchograms it will be seen that the most complete survey of the bronchi is obtained by outlining those of each lung separately and then taking both antero-posterior and lateral radiographs [Figs. 1, 2 & 3]. If the bronchi of both lungs are outlined at the same time they become superimposed in the lateral view and the only way to separate them is to take an oblique radiograph with the chest at an angle of 45 degrees to the *x*-ray film [Figs. 10 & 11].

Pathological processes, particularly lung abscesses, tend to involve one or more broncho-pulmonary segments, and the importance of a knowledge of these subdivisions to the thoracic surgeon has been clearly shown by Brock (1942; 1943). The physician, also, when planning the postural drainage of a suppurative lesion in the lung, must first decide from the *x*-ray which segments are involved, and then place the patient in such a position that the bronchi draining these segments are dependent (Nelson, 1934; Foster-Carter, 1943). For instance, a lesion in the apex of the lower lobe [n] is best drained by placing the patient in the prone position, while one in the middle lobe area [m] will drain most efficiently if he lies on his back.

References

Aeby, C. (1880) *Der Bronchialbaum*, Leipzig
[1] Brock, R. C. (1942) *Guy's Hosp. Rep.* **91**, 111
[2] Brock, R. C. (1943) *Guy's Hosp. Rep.* **92**, 26
Churchill, E. D. & Belsey, R. (1939) *Ann. Surg.* **109**, 481
Ewart, W. (1889) *The Bronchi and Pulmonary Bloodvessels*, London
Foster-Carter, A. F. (1942) *Brit. J. Tuberc.* **36**, 19
Foster-Carter, A. F. (1943) *Proc. roy. Soc. Med.* **36**, 451
Grandgerard, R. & Weber, P. (1935) *Arch. med.-chir. Appar. Resp.* **10**, 181
Hovelacque, P., Monod, O. & Evrard, H. (1937) *Le Thorax*, Paris
Huntington, G. S. (1920) *Amer. J. Anat.* **27**, 99
Kent, E. M. & Blades, B. (1942) *J. thorac. Surg.* **12**, 18
Kramer, R. & Glass, A. (1932) *Ann. Otol. etc., St. Louis*, **41**, 1210
Lucien, M. & Weber, P. (1936) *Arch. d'Anat., d'Histol., et d'Embryol.* **21**, 109
Miller, W. S. (1937) *The Lung*, Springfield
Narath, A. (1901) *Der Bronchialbaum*, Stuttgart
Neil, J. H., Gilmour, W. & Gwynne, F. J. (1939) *Brit. med. J.* **1**, 495
Nelson, H. P. (1932) *J. Anat.* **66**, 228
Nelson, H. P. (1934) *Brit. med. J.* **2**, 251

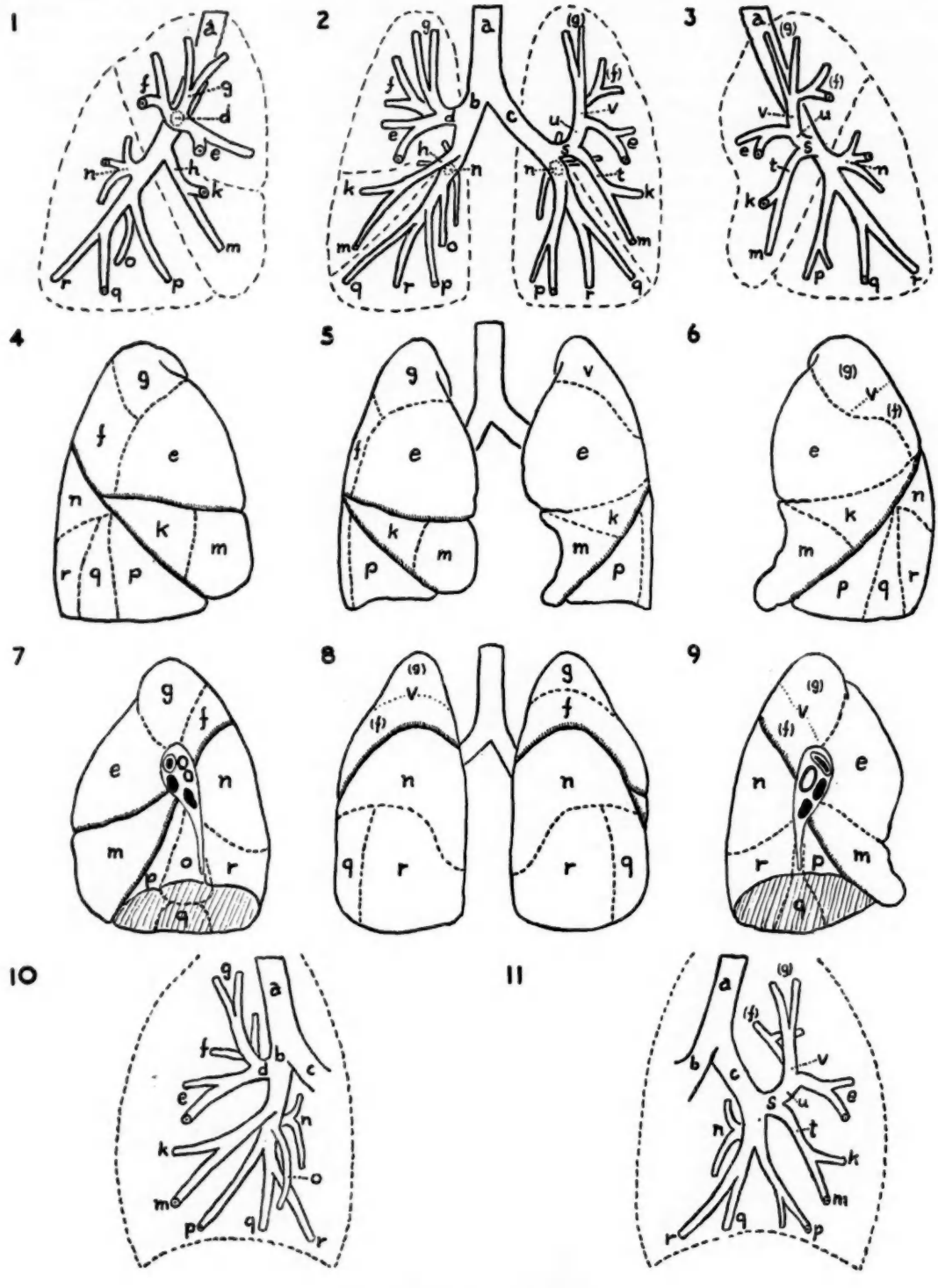
[1] [*see BMB* **247, 249, 250**].

[2] [*see BMB* **248**]

SUMMARY IN DIAGRAM OF THE ANATOMY OF THE BRONCHI AND BRONCHO-PULMONARY SEGMENTS

[These diagrams have been drawn for British Medical Bulletin by Dr. A. F. Foster-Carter. They should be studied in conjunction with the article on the preceding page.]

1. Bronchial Tree, right lateral view.
2. Bronchial Tree, anterior view.
3. Bronchial Tree, left lateral view.
4. Right Lung, lateral view.
5. Both Lungs, anterior view.
6. Left Lung, lateral view.
7. Right Lung, medial view.
8. Both Lungs, posterior view.
9. Left Lung, medial view.
10. Bronchi of Right Lung, left anterior oblique position.
11. Bronchi of left lung, right anterior oblique position.



Key to the Bronchi and Segments

a. Trachea.
b. Right main bronchus.
c. Left main bronchus.
d. Eparterial (right upper).
e. Anterolateral.
f. Posterolateral.
g. Apical.
h. Right middle.
k. Lateral middle
m. Anterior middle.
n. Dorsal.
o. Cardiac.
p. Anterior basic.
q. Lateral basic.
r. Posterior basic.
s. Left upper.
t. Left middle (lingula).
u. Ascending.
v. Apicoposterior.
(f) (g) Posterolateral and Apical branches of the Apicoposterior bronchus.

REVIEW OF SELECTED PAPERS

Applied Anatomy of the Lungs

247

BRONCHIAL ANATOMY AND THE SURGERY OF LUNG ABSCESS

by R. C. Brock, *Guy's Hospital Reports*, **91**, 111–130, 1942

This paper deals with the surgical treatment of abscesses in the right upper lobe. The author stresses that it is essential for the surgeon to have a knowledge of the anatomy of this area and he gives an illustrated description of the branches of the eparterial bronchus which agrees with that of Foster-Carter (1942).

The segment most often involved in a lung abscess is the posterolateral, which occupies the paravertebral part of the right upper lobe below the apex, and extends to the posterior part of the axillary region. The apical and anterolateral segments are less common sites for suppuration. In planning the treatment of an abscess in the right upper lobe, it is essential to study both antero-posterior and lateral radiographs and to remember that a true axillary abscess is rare; an abscess in the axillary area is usually situated in either the posterior or the anterior part.

An abscess may present on the interlobar fissure, which will then show a smooth downward projection in the lateral radiograph. Rupture of an abscess into the fissure produces a characteristic globular or ovoid opacity due to the formation of an interlobar empyema, and this may be mistaken for the abscess itself.

The author advocates the early drainage of lung abscesses and stresses that this must be preceded by very accurate localisation, based upon a knowledge of the segmental anatomy of the region involved. Good antero-posterior and lateral radiographs are the first essential and the position of the most favourable point for drainage, namely the point at which the abscess is nearest to the surface, must be checked by measurement against a fixed landmark such as the sternum in both views [*see also* Cleland & Rackow, 1943]. If the primary segment involved can be ascertained, but the actual abscess is obscured by surrounding pneumonia, it is often possible to drain it successfully at the site of election for that particular segment. The injection of a small quantity of iodised oil mixed with methylene blue into the intercostal tissues over the suspected site is sometimes useful, as it provides a landmark which is visible both in the radiograph and at operation. Bronchoscopy is also of value in localisation; pus will often be seen exuding from the bronchus which drains the affected segment.

Most abscesses of the right upper lobe are best approached through an incision in some part of the axilla. An anterior approach is necessary occasionally, but should be avoided if possible as it tends to produce an ugly deformity. A paravertebral abscess must be drained from the back. Abscesses in the apical segment are uncommon. When they occur, an axillary approach and resection of part of the 3rd rib will usually give dependent drainage.

An abscess of the anterior part of the anterolateral segment will usually have to be drained from the front, and it commonly lies beneath the anterior end of the 3rd rib. The lateral part of the anterolateral segment normally lies beneath the 3rd rib just anterior to the mid-lateral line, and this is the site of election for drainage.

The posterolateral segment is the most common site for an abscess in the right upper lobe. In the lateral radiograph this region is often obscured by the shoulder girdle, and localisation of the lesion may be difficult. Every effort should be made to decide whether the abscess involves the posterior or lateral part of the segment, or both. A paravertebral abscess, in the posterior part, is best drained from the back; it usually lies under the posterior ends of the 4th or 5th ribs and the resection may have to extend back as far as the transverse processes of the vertebræ. An abscess in the lateral part of the posterolateral segment, or one which involves the whole segment, is best drained by resection of part of the 3rd rib high up and far back in the axilla.

Multiple abscesses may necessitate drainage at more than one of these sites simultaneously.

REFERENCES

[1] Cleland, W. P. & Rackow, A. M. (1943) *Brit. J. Tuberc.* **37**, 55

[2] Foster-Carter, A. F. (1942) *Brit. J. Tuberc.* **36**, 19

[1] [*see BMB* **278**] [2] [*findings summarised in BMB* **245**]

248

BRONCHIAL ANATOMY AND THE SURGERY OF LUNG ABSCESS. Part II

by R. C. Brock, *Guy's Hospital Reports*, **92**, 26–37, 1943

In this paper the author first deals with the surgical anatomy of the left upper lobe. [His description agrees with that given in *BMB* **245** except for the exact distribution of the subdivisions of the lingula or left middle bronchus.] He considers that the lateral division of the left middle bronchus extends forwards above the anterior division, so that the corresponding segments should be called upper and lower rather than lateral and anterior. Nevertheless, he states that there is an important lateral branch from the upper division which contributes to the " axillary area " of the left upper lobe. This area is supplied by lateral branches from the anterolateral, posterolateral, and left middle (lingula) bronchi, and is a common site for the formation of an abscess. Brock shows that all these branches are dependent when the subject lies on the left side, and suggests that left axillary abscesses are usually caused by the aspiration of infected material when lying in this position.

The lower or anterior branch of the lingula is of particular importance in bronchiectasis, as it is often involved together with the bronchi of the lower lobe, and then has to be resected when performing a left lower lobectomy. Lee Lander & Davidson (1938) showed that infected emboli from the main bronchus would tend to be aspirated into the left middle bronchus as well as the lower lobe, because of the downward direction of this branch. Brock points out that, for the same reason, when the patient is in the upright position, secretions filling the lower bronchus can spill over into the lingula.

The left apical segment is rarely the site of a lung abscess; the best surgical approach to it would be through the 2nd or 3rd rib, high up and far back in the axilla. Abscesses of the left posterolateral segment can best be reached from the back by resection of the 4th or 5th rib close to the spine. The anterolateral segment is the most common site for suppuration in the left upper lobe, and its lateral or axillary part is most often affected. An abscess in this area should usually be drained in the mid-axilla and the exact level must be carefully determined by radiography as described by Brock (1942). The lateral or axillary part of the lingula is also a common site for suppuration; an abscess in this segment may be indistinguishable radiologically from one in the lateral part of the anterolateral segment, and it is treated in the same way. Abscesses in the anterior parts of the anterolateral or left middle segments usually approach the surface on the anterolateral aspect of the chest, and the best position for drainage is again determined by accurate localisation of the area involved.

The original paper is noteworthy for the profusion of its excellent illustrations.

REFERENCES

[1] Brock, R. C. (1942) *Guy's Hosp. Rep.* **91**, 111

Lee Lander, F. P. & Davidson, M. (1938) *Brit. J. Radiol.* **11**, 65

[1] [*see BMB* **247**]

249

BRONCHIAL EMBOLISM AND POSTURE IN RELATION TO LUNG ABSCESS

by R. C. Brock, F. Hodgkiss & H. O. Jones, *Guy's Hospital Reports*, **91**, 131–139, 1942

The authors quote a number of published accounts to show that a lung abscess is usually confined to one lobe and

occurs more often in the right lung than in the left. They are of the opinion that most lung abscesses are due to the inhalation of infected material, probably during sleep when the patient is lying down. Basal abscesses are common after abdominal operations because the patient is nursed in a sitting position, but the upper lobes are frequently the site of suppuration after other operations, such as those on the nose and throat, when the patient is nursed lying down.

The authors show radiographically that small quantities of iodised oil injected into the trachea, when the patient is lying on his right side, usually reach the posterolateral area of the right upper lobe. This is of particular interest in view of the frequency of suppuration in this segment. When the patient lies on his back, oil from the trachea usually runs into the right first dorsal bronchus supplying the apex of the right lower lobe; it may also enter the posterolateral segment of the right upper lobe and less frequently the apex of the left lower lobe.

The authors point out that these two areas into which oil from the trachea tends to be aspirated, the posterior part of the right upper lobe and the apex of the right lower lobe, are common sites both for a lung abscess and for tuberculous lesions. They suggest that both these conditions may be due to the aspiration of infected bronchial emboli from the upper respiratory tract.

250

THE INTERLOBAR FISSURES OF THE LUNGS

by R. C. Brock, *Guy's Hospital Reports*, **91**, 140–146, 1942

The author is of the opinion that the posterior end of the main fissure is at a lower level than is commonly supposed. Many textbooks of anatomy give the upper level of the main fissure as the posterior end of the 4th rib or the spinous process of the 3rd dorsal vertebra. An abscess in the apex of the lower lobe would therefore be expected to lie deep to the 3rd to 6th ribs posteriorly. This is not the case, and the correct level to drain such an abscess is usually at the 8th rib. Bronchograms rarely show the apex of the lower lobe at a higher level than the 5th to 6th rib, and this is probably the normal upper limit of the main fissure of the right lung. The fissure of the left lung sometimes reaches the level of the 4th or even the 3rd rib. In the original paper, illustrations are given of a dissection of the thorax showing the pulmonary fissures, together with radiographs taken after metal strips had been placed in the fissures.

Experimental Lung Damage

251

THE HISTOLOGY OF THE ISOLATED PERFUSED LUNG

by O. A. Trowell, *Quarterly Journal of Experimental Physiology*, **32**, 203–212, December 1943

In this paper from the Physiology Department of the University of Edinburgh the author describes histological changes in isolated dogs' lungs, which were perfused with heparinised blood under negative-pressure ventilation for a period of 3½–7 hours. A total of 34 lungs was examined in 20 perfusions (by the technique of Daly, Hebb & Petrovskaia, 1941). The lungs of 5 normal dogs served as controls.

From each lung three samples were removed, fixed and stained. The author summarises some of the histological features of the normal dog lung and refers to differences in other species. The constant histological changes seen in the perfused lung were (i) oedema manifested by alveolar exudate, distension of periarterial lymphatics and oedema of arterial walls; (ii) periarterial and peribronchial hæmorrhage, which could also be seen on macroscopic examination; (iii) accumulation of polymorphonuclear leucocytes in small blood vessels, often entirely filling the lumen of the venules. (The disappearance of polymorphs from blood perfused through the isolated lung was observed but not published by R. G. Bickford & F. R. Winton in 1934. Further observations on this point will be reported elsewhere in detail by the present author. The extent of accumulation of polymorphs in some of the small vessels is sufficient to account for their disappearance from the circulating blood); (iv) dilatation of bronchi and bronchioles with smoothing of the normal convolutions of the bronchial epithelium. Appearances suggested loss of tone or reactivity of bronchial muscle (the bronchial circulation was not perfused); (v) vascular congestion of bronchial walls, except where outflow from the pulmonary veins was allowed.

The three main changes described—œdema, periarterial hæmorrhage, and intravascular accumulation of polymorphs—were never evenly distributed, nor did the various changes necessarily occur in association. Bronchial dilatation and congestion were always uniformly distributed when present.

The author reviews the findings of other workers on histological changes after acute oedema and certain types of experimental lung damage. From the reports of these other workers it is evident that the main pathological features of the perfused lung are also found in other types of lung damage, and the author suggests that such changes represent a common reaction to pulmonary trauma. He regards increased capillary permeability as the chief cause of oedema, and rupture of the vasa vasorum as the chief cause of periarterial hæmorrhage. Bronchial congestion was presumably due to some obstruction of the veins draining the bronchial tree.

REFERENCE

Daly, I. de B., Hebb, C. O. & Petrovskaia, B. (1941) *Quart. J. exp. Physiol.* **31**, 129

252

HEALING OF EXPERIMENTAL WOUNDS OF LUNG

by G. L. Montgomery, *British Journal of Surgery*, **31**, 292–299, January 1944

Little information is available on the process of healing wounds of the lung. The author has experimentally investigated this problem at the *Wilkie* Surgical Research Laboratory, Edinburgh. Triangular sections of lung were excised, under endotracheal ether anaesthesia, from 17 adult cats. Wounds were sutured in layers, and the cats recovered quickly and seemed little disturbed by the procedure. They were killed at intervals of from 36 hours to 115 days after operation, and sections of lung at the site of excision were made for study of the histological appearances in different stages of repair.

i. *Reconstitution of the continuity of the pleura.* The pleural limiting membrane was reformed by the cells of the superficial alveoli of the lung. This proliferative change was followed by the production of hyperplastic cells which appeared to originate from the capillary endothelium of the alveolar walls. Fibrin from blood clot deposited on the interrupted pleural surface appeared to stimulate proliferation of remaining serosal cells. Both alveolar endothelium and pleural serosal cells appeared to give rise to the fibroblastic tissue external to the limiting membrane of the lung. The elastica of the pleural membrane developed in the new collagen barrier.

ii. *Regeneration of the lung.* Evidence of regeneration was seen at a very early stage. The most important change was the development of new bronchial buds from the bronchi. These first appeared as cubical cells replacing the columnar ciliated epithelium. Later, cubical cells appeared external to the membrana propria, and at a further stage narrow channels of cubical epithelium developed. This proliferation occurred on the aspect of the bronchus directed towards the wound. The bronchial buds increased in number and size, and muscle fibres and elastic tissue appeared in their walls. At a later stage of regeneration, the lining of the new bronchial ramifications reverted to the columnar ciliated type of epithelium. Cubical epithelium was seen in the proliferative phase in most, but not all, cases. Another change seen was that some of the fibrin of the clot in the wound appeared to be converted into collagen, which later became aerated in various ways. There was also re-expansion of many of the collapsed alveoli in the vicinity of the wound. Other alveoli were lined with cubical epithelium and resembled foetal lung tissue. These were probably newly formed, although the author does not exclude the possibility that they might have been re-expanded existing alveoli. The author was much impressed by the evidence in these sections of intense activity directed towards aeration of the scar tissue. The bronchial epithelium appeared to be affected by environment. When a bronchus was constricted or had to penetrate unusually dense collagen, it tended to become squamous in form. This

suggests the need for careful haemostasis in operations on the lung.

Oedema was absent in all wounds older than 45 hours. The amount of connective tissue diminishes with the increasing age of the wound. This may be due to the rich blood supply, which would not exist, for example, in a chronic tuberculous lesion.

The original paper contains much detail which cannot be discussed here. It is illustrated by 16 photomicrographs of sections of healing lung wounds at different stages.

Dusts causing Lung Disease

253

LUNG TUMOURS IN MICE AND MAN

by J. A. Campbell, *British Medical Journal*, **1**, 179–183, 13/2/43

The author, who is a member of the scientific staff of the *National Institute for Medical Research*, London, summarises and reviews, with the aid of statistical methods, his results from more than ten years' experiments (1932 to 1942) with dusts. Mice in respiratory chambers were exposed once an hour, for six hours, on five days of each week for a year, to a moderate cloud of dust from various substances which have been under suspicion as causes of lung cancer in man. After the dusting was completed, the mice were not killed but were allowed to fulfil their allotted span of life. The author compares his findings with those elucidated from statistics of human lung cancer in Great Britain (Kennaway & Kennaway, 1936; Turner & Grace, 1938), and he refers also to the results of outstanding interest in other countries such as those reported for human lung cancer in Schneeberg (Rostocki, 1928; Schmorl, 1928) and in St. Joachimsthal, Czechoslovakia (Pirchan & Sikl, 1932). He compares these statistical data for human lung cancer with his data for mouse lung cancer as regards:

a. Agents which increase the incidence of lung tumours;
b. the time factor and the influences of age and sex;
c. the factors of susceptibility and heredity;
d. the morphology of the tumours.

Reference is also made to the influence of irritation, both chemical and mechanical.

The dusts tested by the present author on mice include those containing benzpyrene from tarred roads, similar road dust with the tar removed by benzene, Czechoslovak dust containing some radium and arsenic, Czechoslovak dust without radium and arsenic, a nickel dust mixture containing arsenic which has increased the incidence of lung cancer in certain industrial workers in Great Britain, anthracite coal, bituminous coal, coal soot, exhaust soot from an internal combustion engine, steel grindings, silica, brown oxide of iron, alumina, and calcium carbonate.

The evidence of statistics for human lung cancer indicates that an abnormal liability to this disease has been observed among workers exposed to coal gas and tar, those engaged in the preparation and sale of tobacco, metal grinders, engineers, foundry workers, silica workers, chromate workers, workers with a nickel dust mixture, and Czechoslovak pitchblende miners. Also a rather high incidence has been observed in those whose occupation exposes them especially to road dust; these include paviours, road sweepers, and drivers of horse-drawn and motor vehicles. The inorganic substances, therefore, which appear to be dangerous to man include radium, arsenic, a nickel dust mixture, iron, and silica. With dusts containing these inorganic substances the incidences of lung tumours and lung cancer were definitely increased in the author's mice. The tarred road dust, with and without the tar, also increased the incidence of lung tumours in the mice, sometimes to a very high degree. In these respects, the results obtained in the dusting experiments with mice resemble those obtained from statistics for man.

With iron oxide the tumours produced in the mouse's lung were more numerous and malignant than those produced by silica. The author (Campbell, 1943) has recently pointed out that the silica dust did not produce silicotic nodules in the mouse's lungs, although the incidence of lung tumours was increased and there were silicotic nodules in the tracheobronchial lymph nodes of about half the mice. He suggests that when silicotic nodules are produced in the lungs, cancer may be inhibited, and also points out that silicotic nodules may be regarded as simple multiple tumours.

With the aid of the microscope it was possible to distinguish between eight degrees of dust deposit in the lung tissue. When the dust deposit occupied about three-quarters of the lung tissue, it was arbitrarily termed a very heavy deposit, or 100% deposit. Half this amount or a moderate deposit was termed a 50% deposit. Most of the dust deposits which produced lung tumours in mice were only moderate or less in degree. From this the author concludes that the main effect of certain dusts in the development of lung cancer is a prolonged chemical irritation, but it is not possible to exclude entirely some effects of prolonged mechanical irritation by the harder or larger deposits of dust. Such large masses might produce a local stoppage of circulation with a resulting anoxia for the cells among the dust. The lymph tissue in the lung and tracheobronchial lymph nodes also contained deposits of dust which produced hypertrophy of the lymph tissue.

With regard to the influence of age, or the time factor, the large majority of deaths from human lung cancer occur after the age of 55 years—that is in the closing stages of life. Similarly in the mice experiments (Campbell, 1942) the tumours of the lung are rare until the last quarter of the average mouse life of two to three years. It is possible by means of intravenous injection of very small quantities of some of the new carcinogenic agents to produce lung tumours very early in certain strains of mice (Andervont & Shimkin, 1940). The author indicates that it is doubtful whether, with such rapid action, these results can be applied to the usual cases in which a prolonged action seems necessary, unless under these conditions inhibitory agents are present. Such inhibitory agents seem to occur in some mice whose lungs are very resistant to intravenous injection of powerful carcinogenic agents (Heston, 1942).

In human lung cancer males appear to be affected much more often than females, but some observers find that for simple adenoma the reverse is the case. Sex had no marked effect on the incidence of lung tumours in the mouse experiments (Campbell, 1942), but both the male and female mice were equally exposed to the dusts. In man, environmental conditions are usually different for the two sexes for a great part of the day and the author suggests that the entry of women into industry during the war may in time change the distribution of human lung cancer between the sexes.

The milk factor, recently discovered by Bittner (1942) of the U.S.A. to be so important for the development of mammary tumours in mice, has apparently no influence on the incidence of lung tumours. It is evident, however, that by close inbreeding (Strong, 1936) with brother-to-sister matings, it is possible to produce strains of mice either very susceptible or very resistant to development of lung tumours. In this respect, heredity is important, and in man there is a suspicion that some degree of inbreeding may have had an influence in the production of the high incidence of lung cancer in the Schneeberg and St. Joachimsthal miners, since there are similar mines in other parts of the world where there is no such high incidence of lung cancer. In the Czechoslovak region there are also cases of lung cancer among men who have never been in the mines. This seems to indicate some influence of heredity or some factors, for example iron and silica, present in the outside dust as well as in the mine dust. The factor which renders an individual susceptible to the dust is unknown.

Nucleoprotein is stated to be present both in the genes, which are concerned with heredity, and in certain viruses (Stanley & Knight, 1941). The author suggests that some link or chain in nucleoprotein may provide the bridge between the heredity theory and the so-called virus theory held by some observers for cancer in general. So far, there is no evidence that a virus is concerned in lung tumour development, unless a virus is similar to a gene.

In his dusting experiments, the author has produced mouse lung cancers which resemble closely human lung cancers in their morphology and the present paper contains photomicrographs of mouse lung cancers to illustrate this point. Almost all the types of cancer cells found in human lung cancer have been obtained in mouse lung cancers. These include the usual columnar cells of adenocarcinoma, spindle cells, large and small oat cells, spheroidal cells, round cells

and transitional cells between these types. Metastases composed of these various types of cells have also been obtained.

The author concludes from his experiments that there is a similarity between human lung cancers and mouse lung cancers as regards: (i) agents which increase the incidence of these tumours; (ii) the time or age factor; (iii) some aspects of the factor of susceptibility; (iv) morphology of the tumours. The dusts which were found most active in producing lung tumours in mice include tarred road dust with and without tar, Czechoslovak pitchblende dust, iron oxide, silica, and a nickel dust mixture containing arsenic, and the author considers that the main effect of these dusts is a prolonged chemical irritation. He also observed an hypertrophy of the lymph tissue in the lungs and in the tracheobronchial lymph nodes as a result of the exposure to the dusts. He states that there is no fundamental reason why the results obtained for lung tumours in the mouse experiments with dusts should not be applied to man.

REFERENCES

Andervont, H. B. & Shimkin, M. B. (1940) *J. nat. Cancer Inst.* **1**, 225
Bittner, J. J. (1942) *Cancer Research*, **2**, 710
Campbell, J. A. (1942) *Brit. J. exp. Path.* **23**, 191
Campbell, J. A. (1943) *Brit. med. J.* **1**, 269
Heston, W. E. (1942) *J. nat. Cancer Inst.* **3**, 69 & 79
Kennaway, N. M. & Kennaway E. L. (1936) *J. Hyg., Camb.* **36**, 236
Pirchan, A., & Sikl, H. (1932) *Amer. J. Cancer*, **16**, 681
Rostocki, O. (1928) *International Conference of Cancer*, London, 269
Schmorl, G. (1928) *Ibid.* 272
Stanley, W. M. & Knight, C. A. (1941) *Cold Spring Harbor Symposia on Quantitative Biology*, **9**, 255
Strong, L. C. (1936) *J. Hered.* **27**, 21
Turner, H. M. & Grace, H. G. (1938) *J. Hyg., Camb.* **38**, 90

254

FAILURE OF ALUMINIUM TO PREVENT EXPERIMENTAL SILICOSIS

by T. Belt & E. J. King, *Journal of Pathology and Bacteriology*, **55**, 69–73, January 1943

The research reported in this paper from the Department of Pathology of the *British Postgraduate Medical School*, London, is an attempt to confirm the important work of Denny, Robson & Irwin (1939) in which they found that experimental silicosis produced in rabbits by inhalation of powdered quartz could be prevented by admixture with aluminium powder, in the proportion of 1 part of the latter with 99 parts of quartz. The present authors used Kettle & Hilton's (1932) method of intratracheal insufflation instead of simple inhalation, and employed rats instead of rabbits. A single dose of dust was delivered into the lungs of each rat by means of a syringe inserted into the trachea. The dust was suspended in a fluid medium containing equal parts of saline and milk to emulsify the powdered aluminium. Each cubic centimetre of fluid contained 2 mg. of aluminium to 100 mg. of quartz and each rat received 1·5 cubic centimetres. The aluminium, however, failed to inhibit the development of silicotic nodules, although nearly all the nodules contained obvious collections of aluminium particles in their midst. Also in histological appearance there were no important differences from the nodules produced by the quartz alone. Chemical analysis of the lungs proved that the lungs contained aluminium and silica in a proportion higher than 1 in 100 which Denny and his colleagues found sufficient to inhibit the nodules. These observers maintain that this inhibition depends upon the formation of the hydroxide of aluminium and the present authors suggest that the failure of the aluminium to prevent silicosis in their experiments may be due to its being insufficiently hydroxylated. The reason for this is not known.

The authors also carried out some experiments in which 20 to 50 mg. of aluminium suspended in milk-saline were injected into the trachea without silica. They found that aluminium itself is capable of producing considerable pathological change. The metallic particles tend to collect in the terminal bronchioles, forming compact nodular masses which usually become incorporated in the bronchiolar mucosa, often bulging into the lumen, like a polypus, with bronchial epithelium covering them. Relatively little of the aluminium dust gets past the terminal bronchioles into the air sacs.

REFERENCES

Denny, J. J., Robson, W. D. & Irwin, D. A. (1939) *Canad. med. Assoc. J.* **40**, 213
Kettle, E. H. & Hilton, R. (1932) *Lancet*, **1**, 1190

255

RADIOLOGICAL APPEARANCES IN THE DEVELOPMENT OF COAL MINERS' PNEUMOKONIOSIS

by E. A. Aslett, T. W. Davies, & T. I. Jenkins, *British Journal of Radiology*, **16**, 308–313, October 1943

The radiographic appearance of the lesions of pneumokoniosis are well known, but the way in which they develop has not been studied so extensively. This paper is based upon the survey of 31 coal miners who were first *x*-rayed in 1938 during investigations[1] organised by the *Medical Research Council*, and were re-examined in 1942, 3½ years later. It was found that simple nodulation, seen in the earlier stages of the disease, developed into coalescent nodulation and finally into massive shadows. As well as these solid areas of fibrosis which produce massive shadows, a diffuse fibrosis develops in the advanced cases, which causes scarring and contraction and may be a factor in the production of generalised emphysema. In 4 cases the development of the disease was observed by tomography. This showed that the lesions were usually more extensive than they appeared on ordinary *x*-ray examination. The tomographs also suggested that, as the disease advances, the nodules are drawn together to form increasingly compact lesions which eventually become massive shadows.

REFERENCES

[1] *Medical Research Council, Special Report Series*, No. 243 (1942) H.M. Stationery Office, London
[1] *Medical Research Council, Special Report Series*, No. 244 (1943) H.M. Stationery Office, London

Diagnostic Microscopy in Pulmonary Tuberculosis and Carcinoma

256

CARCINOMA OF THE LUNG: The Value of Sputum Examination in Diagnosis

by F. J. S. Gowar, *British Journal of Surgery*, **30**, 193–200, January 1943

The author describes the results of examination of the sputum from 93 patients with suspected neoplasm of the lung, using the "wet-film" method described by Dudgeon (1936). The following is a brief description of the technique:

Fresh sputum, expectorated by the patient on waking in the morning, is collected and poured into a Petri dish. Blood-streaked portions or solid fragments are picked out for examination and smeared on slides. The procedure is then as follows:

i. Fix, by immersing at once in a bath of Schaudinn's solution[1] for 20 minutes,
ii. wash in 70 % alcohol, containing a trace of iodine,
iii. stain with Mayer's hæmalum[2] for 1½ to 2 minutes,
iv. wash with tap water,
v. counterstain with weak eosin,
vi. dehydrate, and mount in Canada balsam.

The slides are examined systematically with a low-power objective, and any suspicious groups of cells are examined with greater magnification. The cells seen in normal sputum are squamous epithelial cells from the mouth and pharynx, and alveolar phagocytes (dust cells) from the lungs. In pathological conditions other types may be seen, such as

[1] *Schaudinn's solution:* Absolute alcohol, 1 vol. Saturated aqueous solution of mercuric chloride, 2 vols. To this stock solution, add glacial acetic acid to the strength of 3 % immediately before use.

[2] *Mayer's hæmalum stain:* Hæmatoxylin, 1 gram. Distilled water 1,000 cm.³ Heat to dissolve and add sodium iodate 0·2 gram, ammonium aluminium sulphate 50 grams, glacial acetic acid 20 cm.³

pus cells, eosinophils, lymphocytes and swollen alveolar cells. Malignant cells occur in groups and stain more darkly than the other cells. Their nuclei vary in size and shape, and often contain nucleoli or mitotic figures. Considerable practice is necessary before malignant cells can be recognised with certainty, but with experience it is even possible to tell the type of carcinoma from which the cells originated.

Of the author's 93 cases, 65 had definite or probable primary growths of the lung; 36 of these had recognisable malignant cells in the sputum. In no case was a mistaken diagnosis made from sputum examination. Of the 36 patients whose sputum contained carcinoma cells, 13 had early growths and appeared operable, showing that the test is of value in the early diagnosis of carcinoma.

The author suggests that this test is a valuable addition to the methods of investigating cases of suspected bronchial neoplasm. It does not replace other diagnostic procedures, such as bronchoscopy but it has the same value as the examination of the sputum in pulmonary tuberculosis. A positive result proves the diagnosis, but a negative sputum test for carcinoma cells does not exclude the presence of a bronchial carcinoma.

This article also includes protocols of a number of typical cases, and some colour photomicrographs of carcinoma cells in sputum.

REFERENCE

Dudgeon, L. S. (1936) *St. Thomas's Hosp. Rep.* **1**, 51

257

BACTERIOLOGICAL INVESTIGATIONS IN A MASS CHEST SURVEY

by J. W. Bigger, *Lancet*, **2**, 699–700, 4/12/43

A preliminary miniature radiography survey of British Army personnel was carried out by Major P. Kerley in 1942, and full-size films were made of 5,737 radiologically abnormal cases. The present paper reports the findings in 20 of these cases referred for bacteriological investigations. The results of examination are set out in the table below:

Group	Diagnosis	Patient's number	Tubercle Bacilli		
			Sputum		Gastric juice (culture)
			microscopic	culture	
I	Pulmonary infiltration considered to be non-tuberculous	1	−	0	0
		2	−	−	−
		3	−	−	−
		4	+	+	−
II	Healed pulmonary tuberculosis: no evidence of activity	5	−	−	−
		6	−	−	−
		7	−	−	−
		8	−	+	−
		9	−	−	+
III	Radiological evidence of bilateral fibrosis and cavitation: no physical signs	10	−	−	−
IV	Active pulmonary tuberculosis suspected	11	−	+	+
V	Active pulmonary tuberculosis diagnosed	12	+	0	0
		13	+	0	0
		14	+	0	0
		15	+	0	0
		16	+	0	0
		17	+	+	−
		18	+	+	+
		19	+	+	−
		20	−	−	+

+ = Tubercle bacilli found − = Tubercle bacilli not found
0 = Not examined

In all 10 cases diagnosed or suspected as active pulmonary tuberculosis, tubercle bacilli were demonstrated. The bacilli were also found in 3 other cases in which active pulmonary tuberculosis was not suspected on radiological or clinical grounds. The author concludes that culture of both sputum and fasting gastric juice is a practicable, valuable and early diagnostic method.

258

THE VALUE OF EXACT SPUTUM EXAMINATION (LARYNGEAL SWAB CULTURE) IN THE DIAGNOSIS AND MANAGEMENT OF PULMONARY TUBERCULOSIS

by D. Munro-Ashman & E. Nassau, *Tubercle*, **24**, 79–84, May 1943

The authors refer to the difficulty of demonstrating tubercle bacilli in patients with minimal lesions. At the *Middlesex County* Sanatorium, Harefield, for the last three years, they have employed, in such cases, the technique of laryngeal swab culture as described by Nassau (1941). This technique is summarised, and its application is illustrated by eight case reports.

REFERENCE

Nassau, E. (1941) *Proc. roy. Soc. Med.* **34**, 387

Neoplasm and Cystic Disease of the Lung

259

SURGICAL TREATMENT OF BRONCHIAL CARCINOMA

by R. C. Brock, *British Medical Journal*, **2**, 257–259, 28/8/43

Primary carcinoma of the bronchus is a common condition in Britain at the present time, and ranks next to cancer of the colon in frequency in men. Although deep *x*-ray therapy may produce a temporary improvement, surgery is the only form of treatment which can achieve a cure. Early diagnosis is essential if surgery is to be successful, and the slightest symptoms in a middle-aged man should be regarded with suspicion and thoroughly investigated.

The commonest early symptom of a bronchial carcinoma is cough; later bronchial obstruction occurs and this is followed by infection of the lung. Recurrent pulmonary sepsis, or the delayed resolution of a pneumonia, in a middle-aged patient should rouse the suspicion of malignant disease. Necessary investigations include good antero-posterior and lateral radiographs of the chest, bronchoscopy and sometimes bronchography.

Four questions are commonly asked about the operation of pneumonectomy for bronchial carcinoma, and Brock gives answers to these questions based upon his own experience:

i. *How often is it possible to operate?* In a total of about 450 cases, seen over a period of 9 years, the chest was explored in 65, and of these 29 were found to be operable. Thus, at the present time, less than 10% of the cases diagnosed are operable, a fact which clearly shows the importance of early diagnosis.

ii. *What is the mortality?* Of the 29 operable cases (26 pneumonectomies and 3 lobectomies), 8 died from the operation, 7 died from recurrence of the growth, and 14 are alive and well. Many of these patients were in poor condition and this number also includes some who underwent the operation as long as 4½ years ago. Recently there have been numerous improvements in technique which are reducing the mortality. In another series of 10 pneumonectomies and 4 lobectomies for bronchial adenoma, there were only 2 deaths. Brock concludes that the mortality from pneumonectomy for carcinoma in a patient under the age of 60 and in good condition, should not much exceed 10%.

iii. *How long may the patient be expected to survive?* In Brock's series, 7 of the 21 survivors died of recurrence; 5 of them within a year of operation. The prognosis is better when the growth is of the squamous-celled type.

iv. *How much can the patient do after a successful pneumonectomy?* Disability is negligible or absent in almost all cases. Occasionally there may be a discharging sinus but this only occurred in one of Brock's 21 cases. There is no deformity, and the patient is able to return to his previous occupation.

260

THE EARLY DIAGNOSIS OF NEW GROWTHS OF THE LUNG

by W. D. W. Brooks, *Practitioner*, **150**, 75–81, February 1943

For purposes of discussion the author defines "early" diagnosis of pulmonary neoplasms as their diagnosis before metastasis or local complications have occurred. He discusses the apparent rise in incidence of pulmonary neoplasms, stresses the need for effective treatment, and believes that present diagnostic measures do not permit of identification at an early enough stage. New diagnostic measures are a necessity. In benign lung tumours early surgical intervention is simple and fairly safe, with good prognosis. Of benign bronchial tumours, adenomata are the most common; the histological examination of material removed at bronchoscopy is the most important means of diagnosis. In bronchial carcinomata the examination of sputum by the wet film method of Dudgeon is an important diagnostic procedure, while bronchoscopic examination reveals nearly 80% of such growths.

261

CYSTIC DISEASE OF THE LUNG (BRONCHO-ALVEOLAR CYSTS)

by F. E. S. Willis & J. Almeyda, *Tubercle*, **24**, 27–36 & 43–58, February & March 1943

The authors, from the *Royal Chest* Hospital, London, use the term "broncho-alveolar cysts" to include all varieties of lung cysts, both congenital and acquired, with the exception of mediastinal and pleural cysts, parasitic cysts and those arising from the breakdown of lung tissue. Calma (1941) pointed out that pulmonary cysts could be either bronchial or alveolar in origin and the authors suggest the following classification of cysts of the lung based on this division:

a. Alveolar Cysts (containing air)
  i. Pneumatocele or solitary alveolar cyst
  ii. Cystic emphysema or multiple alveolar cysts
b. Bronchial Cysts (containing air, fluid or both)
  i. Pneumocyst or solitary bronchial cyst
  ii. Cystic bronchiectasis or multiple bronchial cysts.

In distinguishing between acquired and congenital cysts, the absence of pigmentation and the absence of pleural adhesions and other inflammatory changes suggest a congenital origin. Both bronchial and alveolar cysts tend to communicate with the bronchi and if these communications become partially obstructed, the cyst may become distended with air. Alveolar cysts have a thin wall which is lined with flattened epithelium and contains little muscular or elastic tissue. Bronchial cysts have smooth muscle, elastic tissue and sometimes cartilage in their walls and they are lined with columnar, ciliated epithelium.

In a series of 85 patients considered to have cystic disease of the lung the authors found 60 of the bronchial type and 25 of the alveolar type. The clinical picture depended on the extent of the disease and the occurrence of complications such as infection or tension within the cysts. Hæmoptysis was uncommon with alveolar but common with bronchial cysts. In only one case was there any evidence of a familial tendency to the disease. Complications were present in the majority of instances; spontaneous pneumothorax was the most common complication of the multiple alveolar type of cystic disease, while infection and its sequelæ, such as pneumonia and lung abscess, were the most frequent complications of bronchial cysts.

It may be impossible to distinguish radiologically between the solitary bronchial cyst and the solitary alveolar cyst. The former is usually the smaller and tends to have a thicker wall but, in both, the remainder of the bronchial tree may be normal, apart from distortion, and both may have bronchial communications. Multiple alveolar cysts have a typical "soap bubble" appearance on the *x*-ray film. Multiple bronchial cysts are of two types; in one the affected area is a mass of irregular cystic spaces like a sponge, in the other there are multiple spherical dilatations of the bronchi.

The authors do not discuss the treatment, but express the hope that a fuller understanding of the clinical and pathological features may help in deciding upon a suitable therapy in individual cases. The original paper contains 21 illustrations (1 diagram, 4 photographs, 2 photomicrographs, and 14 radiographs).

REFERENCE

Calma, I. (1941) *Brit. J. Tuberc.* **35**, 40

Therapeutic and Traumatic Collapse of the Lung

262

EFFECT OF ALTITUDE ON CASES OF PNEUMOTHORAX

by G. S. Todd & D. M. Anderson, *Lancet*, **2**, 597–600, 13/11/43

This investigation was undertaken in order to ascertain the effect of flying upon patients with a pneumothorax. This is an important matter in wartime when it may be necessary to transport cases of traumatic pneumothorax by air. Five patients, each with an artificial pneumothorax, were investigated in a special chamber in which the pressure could be adjusted to represent the atmospheric conditions at various altitudes. In this chamber there were facilities for radiological and electrocardiographic examination, and for estimating the vital capacity and collecting samples of the alveolar air.

As the pressure was reduced, the air within the pneumothorax expanded, the lung was compressed and the mediastinum, if mobile, was displaced to the opposite side. The vital capacity was reduced and, at a certain pressure varying with the individual but corresponding with an altitude of between 4,000 and 8,000 feet [about 1,220 to 2,440 m.], the patient began to complain of dyspnœa and distress. Patients with a mobile mediastinum appeared to tolerate high altitudes better than those with a fixed mediastinum. The partial pressures of oxygen and carbon dioxide in the alveolar air showed a progressive fall, but the symptoms were due to the mechanical effect of tension rather than to oxygen lack. The electrocardiographic changes were negligible even when there was marked lateral displacement of the heart.

The authors conclude that no patient with a pneumothorax should be transported by air at a height greater than 4,000 feet. Patients with tension-pneumothorax should not be carried by air at all unless a needle or intercostal catheter has previously been inserted into the pleural cavity and a doctor is in attendance to adjust the pressures during the flight. Pilots or passengers with an artificial pneumothorax should not fly above 4,000 feet for any length of time and should on no account go above 8,000 feet.

The paper is illustrated by serial radiographs taken at different atmospheric pressures and by diagrams of the screen appearances.

263

SOME OBSERVATIONS ON EIGHTY CONSECUTIVE CASES OF INTERNAL PNEUMONOLYSIS

by R. S. Barclay, *Edinburgh Medical Journal*, **50**, 554–557, September 1943

This short paper is based on a series of 80 patients undergoing artificial pneumothorax treatment in whom thoracoscopy with section of adhesions was performed at *Ruchill* Hospital, Glasgow.

The total number of thoracoscopies was 103, as some patients required more than one intervention.

In 57 patients there was an obvious cavity, closure of which was prevented by adhesions. In the remaining 23 patients, adhesions were preventing concentric collapse of the lung.

The author classifies his results as:

Group A (62·5 %): Complete division of adhesions and control of the disease.
Group B (10 %): Incomplete division of adhesions, but control of the disease.
Group C (15 %): Incomplete division of adhesions and disease not controlled.
Group D (12·5 %): Impossible to cut adhesions because of fusion of lung with chest wall.

There were no deaths in the series, and patients were little disturbed by the operative procedures.

The author points out that over 70 % of unsatisfactory types of pneumothorax were converted to satisfactory types by this treatment.

264

PNEUMOPERITONEUM IN THE COLLAPSE THERAPY OF PULMONARY TUBERCULOSIS

by E. Clifford-Jones & N. MacDonald, *Tubercle*, **24**, 97–107, June 1943

The authors, who write from the *Middlesex County* Sanatorium, South Mimms, claim that pneumoperitoneum is a useful adjunct to other forms of collapse therapy. They have had experience of over 60 cases so treated and observed for periods of 3–15 months. Ten of these cases are described in detail in the present paper. The rationale of the method, the indications for its use, and the sequelæ and complications are discussed. A full description of the technique is given. The paper is illustrated by reproductions of 16 radiographs. The authors express their intention of publishing at a later date a fuller report based on a larger series of cases.

Surgical Treatment of Pulmonary Tuberculosis

In the modern treatment of pulmonary tuberculosis, more and more stress is being laid upon the necessity of closing tuberculous cavities. When collapse therapy is indicated, it must be based on sound mechanical principles and it must aim at cavity closure. For this reason the following three papers [*BMB* **265, 266, 267**] *are of particular interest. In them C. Price Thomas* (*Assistant Surgeon to the Brompton Hospital, London*) *discusses the mechanism by which cavities in the lung may become closed and gives a detailed description of the technique and results of the modern thoracoplasty operation.*

265

PULMONARY CAVITIES: Their Persistence and Closure

by C. Price Thomas, *British Journal of Tuberculosis*, **36**, 4–19, January 1942

It has long been recognised that the healing of a pulmonary cavity is accompanied by obliterative changes in the bronchi which drain it. The author suggests that a very early cavity, produced by the rupture of a tuberculous focus into a bronchus, will tend to close spontaneously as a result of the inherent retractility of the lung, provided that there is free bronchial drainage and sufficient healthy lung around the cavity to allow compensatory emphysema to occur.

Persistence of such a cavity may be due either to continued ulceration of the lung, to the traction of the chest wall, or to the inflationary action of the bronchial air stream; the last factor is probably the most important. It is suggested that the tuberculous process causes a partial stenosis of the draining bronchus, so that air is trapped in the cavity and prevents it from closing. As the disease progresses, free bronchial drainage often becomes established, but by this time the affected area is usually adherent to the chest wall and this holds the cavity open. Even at this stage, however, complete occlusion of the draining bronchi will cause obliteration of the cavity by absorption of the air within it, if the lung can be relaxed. Therapeutic measures such as rest, artificial pneumothorax, diaphragmatic paralysis and thoracoplasty, cause tuberculous cavities to close by promoting obliteration of their draining bronchi. This takes place by diminution of the inspiratory traction on the bronchial walls and, in the case of relaxation methods, by reducing the calibre of the bronchi and thus converting a partial into a complete stenosis.

266

EXTRAFASCIAL APICOLYSIS WITH THORACOPLASTY

by C. Price Thomas & W. P. Cleland, *British Journal of Tuberculosis*, **36**, 109–138, July 1942

The most perfect form of pulmonary collapse is that produced by an artificial pneumothorax completely free from adhesions. This gives concentric relaxation of the lung, which in turn relaxes the cavity and its draining bronchi and eliminates inspiratory traction on the diseased area.

The ordinary paravertebral or lateral thoracoplasty will close the cavity in only about one-third of cases, because it does not allow vertical relaxation of the lung. In fact, when operating again upon a patient who has had a paravertebral thoracoplasty, the forcible movement of the apex of the lung with each inspiration may readily be seen.

The combination of apicolysis with thoracoplasty overcomes this disadvantage and reproduces, as closely as possible, the conditions of concentric relaxation obtained by artificial pneumothorax. The apex of the lung should be mobilised in the extrafascial plane, rather than in the extrapleural plane, because it is then less liable to re-expand, there is less danger of opening tuberculous cavities, and the procedure can be applied to all types of case. Semb, who first described this operation, advocated the removal of the first 3 ribs only at the first stage. Price Thomas adds to this, resection of limited segments of the posterior ends of the 4th and 5th ribs.

This new technique allows extensive stripping of the apex on the mediastinal surface and in the paravertebral gutter, but leaves a stable chest wall below the level of the 3rd rib, thus preventing paradoxical movement. The cavity and its drainage area can often be completely relaxed at the first operation, and over 90 % of cavities can be closed by this method in selected cases. Further resections of rib are carried out at later operations until relaxation has been extended downwards to include the 7th rib, so that the scapula can be properly bedded in front of the 8th rib.

In the selection of cases for operation, the patients may be classified into three groups, (i) stationary, (ii) relapsing, and (iii) "slipping," according to the way in which their disease is progressing. Those in the first two groups are the most suitable for thoracoplasty. The relapsing case should be treated during a period of clinical improvement. Patients in the third group, who are slowly but progressively deteriorating, are occasionally suitable for operation; for example, those with only a little, stationary disease in the relatively healthy lung, and in whom deterioration is slow; but such cases require very careful selection.

The age of the patient must also be considered. Operation is rarely indicated over the age of 45. The age of the disease is also important. If it is of 8 to 10 years' duration, the prolonged toxæmia will often have impaired the patient's capacity to withstand operation.

Pre-operative treatment includes careful tuition in diaphragmatic breathing and instruction in arm and shoulder movements. Patients are also made to practise wearing an oxygen mask, and are taught to cough gently but effectively.

Local anæsthesia is used for the operation, and includes blocking the brachial plexus and the intercostal nerves in the intervertebral foramina. The advantages of local anæsthesia are:

i. Quiet respiration, which reduces the paradoxical movement of the mobilised apex,
ii. preservation of the cough reflex, enabling the patient to keep his bronchial tree clear during the operation,
iii. reduction of hæmorrhage by the use of adrenaline mixed with the local anæsthetic,
iv. reduction of post-operative shock.

At the first-stage operation, the 3rd rib is resected subperiosteally, followed by the 2nd and then the 1st. The apex is then mobilised in the extrafascial plane. The extent of the mobilisation is determined by the type of disease and the condition of the patient; a soft apex and a toxic patient

are indications for restricted mobilisation, but in the case of a firm solid apex it is safe to resect the posterior parts of the 4th and 5th ribs and to continue the separation down to this level.

The second-stage operation is carried out 14 days after the first, if the patient's condition is satisfactory. It consists of further rib resections to carry the relaxation below the level of the diseased area. Patients who are in poor condition require small rib resections with mobilisation at each stage.

The most important accident which may occur during operation is the opening of a tuberculous pulmonary cavity. When this happens, the cavity should be aspirated, and mobilisation should be continued down to the 7th rib, thus freeing the cavity completely. It should then be closed firmly with three layers of catgut sutures.

After operation, the patient is nursed in the semi-recumbent position, and oxygen is used freely when necessary. Expectoration of sputum is encouraged by the administration of expectorants, with small doses of morphia to allay the pain of coughing, and by firm manual pressure to support the mobile chest wall while coughing. Blood transfusion is occasionally required between the stages of the operation.

Gentle arm and shoulder movements and breathing exercises are started on the 2nd or 3rd day after operation, in order to reduce scoliosis and to preserve the mobility of the arm. These exercises reduce the final deformity to a minimum. After the last stage, the patients are kept in bed for 12 weeks to allow firm healing of the cavity, and later they are given graded exercise at a sanatorium.

Post-operative complications include:

i. *Atelectasis.* This is seen in about 20 % of cases; it is due to bronchial obstruction from retained sputum and occurs commonly on the 2nd or 3rd day after operation. The physical signs and *x*-ray reveal displacement of the mediastinum to the affected side, with collapse of the lung. This is most common on the side of the operation. Treatment consists of encouraging expectoration, as already described, combined with postural drainage. In most instances the lung gradually re-expands but, in a few, pulmonary suppuration or tuberculous spread occurs. Such patients, if they survive, require a total thoracoplasty to relax the whole lung.

ii. *Spread of tuberculosis.* This may delay the operations but will usually resolve sufficiently to enable them to be completed.

iii. *Pneumonia due to other organisms.* This is not common and it will sometimes respond to sulphonamide therapy.

iv. *Spontaneous pneumothorax.* This may occur on either side.

v. *Infection of the extrafascial space.* This is manifested by persistent pyrexia, and distention of the space can be seen in the radiograph. If, as is most common, the infection is tuberculous, the space must be aspirated, but if it is pyogenic the space must be drained with a tube.

vi. *Hæmorrhage into the extrafascial space.* This is treated by aspiration and blood transfusion if required.

[*A very full account of the operative technique, including details of the local anæsthesia and many illustrations, is given in the original article.*]

267

THE RESULTS OF THORACOPLASTY

by C. Price Thomas & W. P. Cleland, *British Journal of Tuberculosis*, **37**, 2–9, January 1943

In this paper the authors review 120 cases treated by thoracoplasty in a period of 7 years. The duration of observation after operation varied from 1 to 9 years, and there was a steady decrease in the operative mortality during the period under review, as increased experience was gained in selecting cases for operation and in technique. The more extensive modern thoracoplasty with apicolysis actually carries a much lower mortality than the earlier lateral thoracoplasty.

Employing the classification of disease already described,[1] it is shown that the mortality in the "slipping" case is six times as great as in the "stationary" case. It is interesting that patients in whom the disease had been present for more than 2 years fared much worse than those with earlier disease; this suggests that the operation should not be delayed too long in the hope that fibrosis will occur, for the longer the disease is present, the more extensive will it become.

There is a direct relationship between the extent of the disease in either lung and the operative mortality. In a group of 30 patients with less than two-thirds of one lung affected, and minimal or no disease in the opposite lung, there were no deaths; whereas in a similar group of 28 patients with moderate disease in the contralateral lung there were 8 deaths. In a series of 23 patients with total involvement of one lung and moderate disease of the other, 13 died. A pneumothorax is often of value in controlling disease in the contralateral lung before operation.

The authors' operation, embodying an extensive apicolysis, is more effective than any other in promoting cavity closure. In fact, there was no failure to close the cavity in a series of 25 cases, whereas out of 72 patients treated by thoracoplasty with apicolysis down to the 4th rib only (Semb's operation), 41 still had open cavities. The great importance of cavity closure is clearly shown by the survival rates. Of 51 patients whose cavities closed after operation only 1 died, and in 3 the cavity re-opened. Of 45 patients who still had open cavities after operation, 11 died.

The figures also show clearly that the operation of thoracoplasty does not itself cause permanent incapacity, for in a series of 58 patients, 45 were working, in most cases at their previous occupation. The authors conclude that the more extensive thoracoplasty operations employing apicolysis increase the prospects of cavity closure and sputum conversion, but they do not increase the mortality or the risk of complications.

[1] [*BMB* **266**]

268

CLOSED SUCTION DRAINAGE OF TUBERCULOUS CAVITIES

by T. H. Sellors, *Tubercle*, **23**, 239–250, November 1942

Until recent years the drainage of tuberculous cavities was rarely performed because of the fear of disseminating the disease by opening healthy lung tissue. Coryllos, Monaldi and others have now shown that closed suction drainage can be used successfully in the treatment of certain types of tuberculous cavity, and this method has been the subject of much recent clinical research in Great Britain. The present author reviews the results of this type of treatment in the light of his own experience of over 100 cases. He suggests that suction drainage should be applied only to the large, thin-walled, spherical type of cavity. Such a cavity is kept open because valvular stenoses of the bronchi which communicate with it allow air to enter but not to escape from the cavity; it is surrounded by a zone of compressed lung tissue which will re-expand and allow the cavity to close when the pressure of air within it is reduced. The ideal case for drainage is that in which the patient has a cavity of this type with little surrounding infiltration, and in which a pneumothorax has failed. Cases with multiple or thick-walled cavities and heavy pulmonary infiltration are not suitable for this form of treatment. The author stresses that suction drainage by itself will rarely produce permanent closure of a cavity and that it is most useful as a preliminary to some other form of mechanical collapse therapy, particularly thoracoplasty.

In his description of the technique of drainage the author emphasises the importance of ensuring that the pleural layers are adherent over the selected site. If a large pneumothorax pocket can be induced, the insertion of a thoracoscope and powdering the lung surface with 0·5 % iodine in talc powder is the best method of producing adhesions. In the case of a small pocket the injection of 0·1 to 0·3 cm^3. of 10 % silver nitrate solution [*see also BMB* **44**] or 0·05 g. of sodium aurothiosulphate ("crysalbine," "sanocrysin") in 2 cm^3. of saline solution has been found to be effective. When the pleura is adherent, the cavity is localised carefully by means of *x*-rays and fluorography, and a fine barium-impregnated rubber catheter is inserted into it with a special trocar and cannula. This operation is not performed under the *x*-ray screen because of the danger to the operator's hands. In treating an apical cavity the tube is usually inserted through the first or second intercostal space anteriorly.

Continuous suction is applied to the tube by an electric pump, and the author advocates a negative pressure of 3 to 5 cm. of mercury [*compare BMB* **269**]. Progress is controlled by serial radiograms, and the tube is shortened as the cavity becomes smaller. The patient usually feels immediate benefit from the treatment because the amount of his sputum is reduced.

The results of cavity drainage in 82 cases are analysed: the size of the cavity was reduced in 49 instances, in 14 there was no appreciable change, in 12 the cavity appeared to be obliterated, and in 7 it closed but reappeared. A thoracoplasty was subsequently performed in 21 cases, but in most of these a less extensive operation was necessary than would have been the case if the cavity had not been drained. When performing an upper thoracoplasty after draining an apical cavity, the extent of the apicolysis may have to be limited to avoid encroaching on the track of the drainage tube.

The author believes that the possible indications for cavity drainage will increase if it is understood that it is only a preliminary procedure and not a final form of treatment.

269

THE DRAINAGE OF TUBERCULOUS CAVITIES

by R. J. C. Maxwell & M. L. Kohnstamm, *British Journal of Tuberculosis*, **37**, 24–43, January 1943

The authors, from the Surrey County Sanatorium, give a very full account of the technique and indications for the drainage of tuberculous cavities. Their apparatus for applying suction consists of a pump with a regulating device designed to give a very gentle negative pressure. After a cavity has been drained, a suction of -2 to -4 cm. of water is applied during the day and discontinued at night; this is increased very gradually over a few weeks until a maximum suction of -15 cm. of water is reached. Higher negative pressures are said to rupture the fragile capillaries in the cavity wall. These authors have studied the fistulæ by which cavities communicate with the bronchial tree by means of *x*-rays taken after iodised oil has been inserted into the cavity through the drainage tube. They consider that cavities which have more than four bronchial fistulæ will not respond to drainage, but that those with three fistulæ or less will be reduced in size and very occasionally may become permanently closed. They regard suction drainage as a preliminary to surgical collapse rather than as a curative procedure, and they stress its value in improving the general condition of the patient and lessening the extent of the subsequent thoracoplasty.

270

ARTIFICIAL BRONCHIAL OCCLUSION BY PLASMA CLOT IN THE TREATMENT OF CHRONIC TUBERCULOUS CAVITATION

by D. Thomas, J. Gough & B. M. Still, *British Journal of Tuberculosis*, **37**, 44–46, January 1943

The authors, from Sulley Hospital and the Welsh National School of Medicine, working on the theory that occlusion of the bronchi communicating with a tuberculous cavity will allow the cavity to close, have evolved a means of plugging these bronchi. A Monaldi drainage tube is first inserted into the cavity and, theoretically, if the bronchial fistulæ are then closed, suction on the tube will cause the cavity to become obliterated. Twenty cm.^{3} of blood are taken from the patient into a sterile tube in which 2 cm.^{3} of a 1·35% solution of sodium oxalate have been evaporated to dryness. The oxalated blood is then centrifuged and the plasma is removed. One cm.^{3} of the plasma is mixed in a test tube of 1 cm. diameter with 0·2 cm.^{3} of diodone [a mixture or loose combination of 3, 5-diiodo-4-pyridone-N-acetic acid and diethanolamine, known also as "Per-Abrodil" and "Pyelosil"] and 0·8 cm.^{3} of viper venom (Stypven). 0·1 cm.^{3} of a 4·5% solution of anhydrous calcium chloride is then added, and the clotting time is measured with a stop watch. This should be from one to three minutes at room temperature. Sufficient plasma to fill the cavity and its draining bronchi is then taken and mixed with the appropriate amounts of diodone and viper venom; finally the calcium chloride is added and the mixture is injected through the drainage tube into the cavity, during the last thirty seconds before it is due to clot. The authors claim that, if the injection is successful and the patient does not cough, firm plugs of fibrin form in the bronchi and occlude them. This work is still only in a preliminary stage but the results are promising.

Chest Surgery in Wartime

271

WAR WOUNDS AND INJURIES OF THE CHEST

by A. Tudor Edwards, *British Journal of Surgery*, **31**, 74–86, July 1943

This is a critical review by one of the most distinguished of contemporary thoracic surgeons and contains 89 references to the literature.

The author discusses the incidence of wounds of the chest in previous wars and points to the relative increase in the number of chest casualties under modern battle conditions. In the section on non-penetrating injuries are discussed simple fractures of one or more ribs; anterior and posterior fractures of several ribs resulting in partial collapse and paradoxical movement of a segment of the chest wall; traumatic asphyxia; injuries of the lung and pleura; cardiac injuries; and injuries from explosion blast. In the section on penetrating wounds, tension pneumothorax, open pneumothorax, and indications for early operation are included.

There are separate sections on abdomino-thoracic wounds, hæmothorax,[1] late removal of foreign bodies, atelectasis in chest injuries, the value of radiology, wounds of heart and pericardium, diaphragmatic hernia, and transport. The use of sulphonamides in the prophylaxis and treatment of infection receives attention in different sections.

[1] [*see BMB* **45** *for a review of a paper by the same author on traumatic hæmothorax.*]

272

THORACIC INJURIES: The Rôle of the General Surgeon in the Forward Area

by C. Price Thomas, *British Journal of Tuberculosis*, **37**, 103–115, July–October 1943

War experience in Libya has shown that the specialised thoracic surgery unit should be mainly concerned with the later treatment of chest injuries in relatively stationary areas.

The more serious thoracic injuries often cause death by interference with the cardio-respiratory system before there is any possibility of removal to an operating unit. After the first 48 hours, infection is the commonest cause of death.

The forward (non-specialist) operating unit should aim at reducing shock, by the use of warmth, morphine, transfusion and oxygen. Radiographs should be taken when an *x*-ray unit is available. The commonest causes of interference with the cardio-respiratory system are (i) open pneumothorax and (ii) tension pneumothorax. The author outlines the emergency treatment of both these conditions.

Surgical emphysema is only occasionally severe. When present it should be treated by finding and dealing with its cause—often a tension pneumothorax. The older method of multiple incisions is discredited.

Severe crushing of the chest wall, with paradoxical movements, requires strapping, reinforced by cardboard or plaster of Paris. Hæmopericardium is not common, and it is doubtful whether surgical intervention should be attempted by the forward operating unit. Hæmothorax, except (i) where ribs are shattered on the entry side, (ii) in the case of parasternal wounds, should be treated conservatively by aspiration without gas replacement.

The author concludes with a warning against too great a reliance on chemotherapy. Scrupulous surgical technique remains essential.

273

THE PATHOLOGY OF CLOSED INJURIES OF THE CHEST

by J. V. Wilson, *British Medical Journal*, **1**, 470–474, 17/4/43

The conclusions of the author, who is serving with the British Army, are based on two years' experience of performing routine autopsy examinations on battle casualties.

By a closed injury is meant one in which the pleura has not been penetrated; such injuries may be grouped under the following headings:

i. *Lacerations.* Rupture of the heart or great vessels usually causes instant death. Laceration of the lung is common, rarely severe, and seldom causes death by itself but its complications may be fatal. The chief of these are hæmorrhage, compression of the lung and infection. Hæmopneumothorax is common and requires prompt treatment, the amount of air in the pleural cavity is usually not great, but bleeding is often profuse. Hæmorrhage from the lung is rarely severe, as the pressure in the pulmonary artery is low, but bleeding from intercostal or the internal mammary vessels is often profuse and difficult to control. In addition, the blood acts as a foreign body and causes an outpouring of exudate from the pleura, which increases the volume of the effusion and the dehydration of the patient. Blood in the pleural cavity often remains fluid; this may be due to the absence of thrombokinase in cases where there is little tissue damage, or to defibrination of the blood by the movement of the lung and heart. Compression of the lung by air, fluid, or both, is another common complication. Infection of the pleural contents from the lung can occur in closed injuries.

ii. *Contusions.* Bruising of the thoracic viscera is most often seen in young subjects in whom the chest wall is elastic Myocardial contusions may be caused by a direct blow on the chest or by high explosive blast. The anterior surface of the ventricles is the most common site and the myocardium appears dark and hæmorrhagic, not unlike an infarct. Rupture of the heart may occur. Pulmonary contusion due to direct trauma produces an area of hæmorrhage at the site of the blow and generalised congestion with small scattered capillary hæmorrhages throughout the lung. The lesions are identical with those observed following exposure to blast.

iii. *Blast injuries.* The common findings are scattered areas of hæmorrhage throughout the lungs, both subpleural and deep in the parenchyma, dark subpleural hæmorrhages along the lines of the intercostal spaces, and often extensive hæmorrhages posteriorly in the region of the apex and those parts of the lung in contact with the paravertebral structures. If the injuries are not immediately fatal, recovery is the rule, the hæmorrhages coagulate and absorb like a pneumonic exudate. The chief complications are pneumothorax, acute pulmonary œdema with heart failure, and bronchopneumonia. The lesions are probably due to the impact of the pressure wave on the chest wall and are therefore similar to contusions. Many cases also show bruising of the myocardium and mediastinal structures. The cause of death in blast injuries is still uncertain; it may be due to the pulmonary hæmorrhages, to cerebral damage from compression, to ventricular fibrillation following contusion of the heart, or to air embolism.

[*see also BMB* **274**]

274

PATHOLOGICAL FINDINGS IN A SERIES OF BLAST INJURIES

by J. V. Wilson & R. E. Tunbridge, *Lancet*, **1**, 257–261, 27/2/43

A number of pathological studies on blast injuries have already been published. The present series is reported because of the uniqueness of the incident, the large number of cases involved, and the strong evidence that blast alone was the cause of death.

During a heavy dive-bombing attack at Malta, a bomb fell in front of, and within five yards from, the entrance of a deep and crowded tunnel shelter in solid rock, open at both ends and entered by three right-angled turns. The flame passed straight into the entrance, blackening the rock, and survivors described a wind of tremendous force sweeping through the shelter. The electric light was extinguished and the inmates were thrown against each other. The bomb was probably of 500 kg. size. The entrance was completely demolished, but the shelter itself was intact; the concrete roof of the exit was disturbed. Many of the occupants were sleeping in cubicles hewn in the rock at the sides of the shelter at the time of the explosion. Those standing in the entrance were dismembered.

Help arrived within five minutes of the explosion. The first person to enter the shelter after the incident, thought at first that all the occupants were dead, as no one moved or answered. However, this was not so, and though all survivors were confused and dazed some were later able to return home without medical treatment. There was no evidence of burning or noxious fumes. A number of persons in bunks near the entrance were dead. Amongst the fatalities (eleven immediate and one eight hours later) were twelve in which no external injuries were seen and death could be presumed to be purely an effect of blast. Postmortem examinations (excluding the brain and spinal cord) were made upon these and are described in detail in the original paper. The finding which was characteristic of all these cases was the presence of extensive bilateral pulmonary hæmorrhages, associated with frothy blood-stained fluid in the mouth and upper air passages. The pulmonary hæmorrhages involved the deeper portions of lung tissue, and were continuous with gross ecchymoses on the surface of the lungs and visible beneath the pleura. These subpleural hæmorrhages had no constant pattern and varied considerably in extent. Rib markings were a feature of all cases. The sites of election for the sub-pleural hæmorrhages were the anterior margin, the costal surface, and the posterior surface of the lungs: the inferior margin was never extensively involved. Microscopically, there was hæmorrhage into the alveoli and marked congestion of the alveolar capillaries, even in areas free from gross hæmorrhage and, it is interesting to note, in a few cases there was œdema-fluid in the alveoli.

In the abdomen, in six cases, the vessels of the omentum, mesentery and peritoneum were congested and surrounded by small ecchymotic hæmorrhages. There were no ruptures of abdominal viscera. In one case there was a rupture of the aorta.

In their discussion of the cause of death the authors exclude poisoning by gaseous fumes or carbon monoxide, asphyxia, burns, fat embolism, and trauma other than that due to blast: they conclude that the primary lethal factor was blast. They concur with the view of Zuckerman (1940) that the lesions are produced by the traumatic effect of the blast upon the chest wall. They consider that the pulmonary lesions are not always of themselves sufficient to cause death and that, in such instances, the cause may lie in an acute effect upon certain vital centres.

REFERENCE

Zuckerman, S. (1940) *Lancet*, **2**, 219

[*see BMB* **46** *for a short list of papers dealing with the effects of explosion blast on the lungs; also BMB* **273** *in this number.*]

Scope of Chest Surgery: Rehabilitation: Chest Radiography: Atypical Pneumonia

275

THE SCOPE OF MODERN CHEST SURGERY

by O. S. Tubbs, *Practitioner*, **150**, 82–88, February 1943

The author reviews the part of the surgeon in the treatment of acute empyema, chronic non-tuberculous empyema, lung abscess, bronchiectasis, bronchial tumours, chest injuries, suppurative pericarditis, patent ductus arteriosus, and angina pectoris. Surgical methods and post-operative care are referred to only in connection with diseases likely to be treated in small hospitals. The surgical treatment of pulmonary tuberculosis is excluded, as tuberculous patients are not usually referred to the surgeon by the general practitioner, to whom this paper is chiefly addressed.

276

REHABILITATION OF THE CHEST CASE

by F. R. Edwards, *Lancet*, **1**, 81–84, 15/1/44

In this paper from the Liverpool and North Western Unit of the *Emergency Medical Service* the author defines the special measures necessary for the restoration to optimal functional capacity of a patient who has sustained a chest injury or operation. Rehabilitation of the chest case is

based on the same fundamental principles as other forms of rehabilitation, but differs in detail.

Nearly all patients who enter a thoracic rehabilitation centre complain of dyspnœa on exertion. This is associated with a reduction in vital capacity attributable to (i) weak respiratory musculature from trauma and long rest in bed, (ii) damage or distortion of ribs, (iii) pleural thickening and adhesions, (iv) pulmonary fibrosis after destructive inflammatory lesions, (v) loss of lung tissue, as in lobectomy or pneumonectomy, (vi) emphysema, which is commonly found in military patients and often attributable to the unnaturally erect stance adopted, (vii) pain after fracture of ribs, operation, or insertion of drainage tubes.

These factors leading to diminution in vital capacity may be present singly or in association. They should be separately assessed and the appropriate remedial measures should be taken.

The investigation of the patient on admission to the rehabilitation centre includes a full history; clinical and radiographical examination; measurement of weight, chest expansion, and abdominal expansion. A spirographic tracing is taken, and gives information on tidal air; pulmonary ventilation in litres per minute; vital capacity; complemental air; supplemental air; and maximal breathing capacity. Deductions may also be made from the shape of the curve (Cournand, Richards & Darling, 1939).

The patient is then graded for exercises and joins an appropriate class. Improvement is checked by re-examination, and he progresses to higher grades. Fluoroscopy is of great importance in assessing defects, and areas of deficient ventilation are demonstrated to physiotherapists for special attention. This visual demonstration is of particular value to the rehabilitation staff. Progress is also checked by radiography, physical measurements, and spirographic tracings (the use and analysis of these will be the subject of a later communication by the author). A standard exercise test is also described.

As regards exercises, the first essential is the teaching of correct breathing, and this is started as soon as the patient's physical condition permits. Shoulder and scapula movements, with side-bending and rotating of the chest, develop the accessory muscles and resolve intermuscular and periarticular adhesions.

General exercises and games follow the usual lines, and instructors are trained to notice early signs of distress. In the different classes a competitive spirit is encouraged. To avoid fatigue, afternoons are free for recreation, entertainments and country walks. The author stresses the importance of early rehabilitation.

From a considerable experience, the author believes that a chest rehabilitation centre can restore the majority of patients to a high level of performance in a remarkably short time. Patients should be allowed to go home occasionally during their period at the centre.

REFERENCE

Cournand, A., Richards, D. W. J. & Darling, R. C. (1939) *Amer. Rev. Tuberc.* **11,** 5

277

PULMONARY COMPLICATIONS OF THE COMMON COLD AND SINUSITIS: Findings in Mass Radiography

by J. A. Kennedy, *Lancet*, **1,** 769–771, 19/6/43

The author reviews 100 examples of transient radiological opacities in patients with the symptoms of a common cold. These shadows were noticed during the routine mass miniature radiographic examination of *Royal Air Force* personnel. The pulmonary shadows were commonly small, and almost always situated in the lower zones of the lungs. They were rarely accompanied by constitutional disturbance and the majority resolved spontaneously within two weeks. Coryza and a slight productive cough were the common symptoms, but 9 of the 100 patients were symptomless. The condition was most common in the winter months from December to May; most patients commenced to have symptoms 7–14 days before the radiographic examination, and only 11 were pyrexial when examined.

The right lung was affected in 49 patients, the left lung in 30, and 21 had bilateral lesions. Only 2 patients had lesions in the upper lobes, the majority being situated in the posterior part of the lower lobe. Radiographically the lesions were of 3 types, (i) patchy bronchopneumonic shadows, (ii) circumscribed homogeneous opacities, and (iii) increased basal striations. The author suggests that these lesions were due to the inhalation of infected material of low virulence from the upper respiratory tract.

[This condition differs clinically and to some extent radiologically from the primary atypical pneumonia described by Drew, Samuel & Ball (1943). It is probably identical with a condition reported by Ramsay & Scadding (1939) which they called "benign circumscribed pneumonia."]

REFERENCES

[1] Drew, W. R. M., Samuel, E. & Ball, M. (1943) *Lancet*, **1,** 761

Ramsay, H. & Scadding, J. G. (1939) *Quart. J. Med.* **32,** 79

[1] [*see BMB* **281**]

278

RADIOLOGY IN POST-OPERATIVE CHEST SURGERY

by W. P. Cleland & A. M. Rackow, *British Journal of Tuberculosis*, **37,** 55–63, April 1943

The complications which follow operations on the chest are numerous and often require urgent treatment. Diagnosis is made difficult by the fact that the patient is so ill that easy physical examination is often impossible and radiological examination thus becomes of paramount importance. Radiographs of such patients present special problems and these are discussed by the authors. They stress the necessity for taking both true postero-anterior and true lateral views in order to obtain a complete picture of the thoracic contents. Considerable penetration is often necessary, usually 75 to 85 kilovolts, and in many cases where lesions are obscured by fluid or by the heart shadow, a Bucky or stationary grid is an advantage, although this cannot be used if the patient has to be *x*-rayed in his bed with a mobile unit. The standard teleradiographic distance of 5 feet [about 1·5 m.] should be used whenever possible, and the central ray from the tube should always be horizontal so that fluid levels will be clearly shown.

Operations for the removal of tumours of the chest wall often penetrate the pleura, and there may be a post-operative hæmothorax. Tangential radiographs will distinguish between this and a hæmatoma of the chest wall.

After extra-pleural pneumonolysis, blood and serum may collect and clot in the extra-pleural space. This clot may be mistaken for a collection of fluid but its upper level will not change in position when the patient's posture is altered.

After an upper thoracoplasty combined with an extra-fascial apicolysis, a fluid level will be seen in the space originally occupied by the apex of the lung. Effusion or hæmorrhage into this extra-fascial space, with or without infection, produces an opacity in this area, the fluid level is no longer seen, and air is often driven up into the tissue planes of the neck.

The management of collections of pus or fluid in the pleural cavity is one of the most frequent tasks of the thoracic surgeon. In determining the site for aspiration, the postero-anterior film will show the relation of the effusion to the anterior and posterior ends of the ribs, and the lateral film will show its situation in the sagittal plane. From these two views the surface markings of the effusion can be outlined. 15 or 20 cm.[3] of iodised oil, introduced through the aspirating needle when an empyema is found, will sink to the bottom and outline the lower limit of the cavity when the patient is in the erect position. This is a useful guide for subsequent drainage. Opaque media such as iodised oil are also of great value in delineating pleural and pulmonary cavities radiographically after surgical drainage has been performed. When the opaque medium has been injected a postero-anterior film is taken in the prone or supine position and a lateral film in the erect position. These will show both the upper and lower limits of the cavity.

If iodised oil is not obtainable, a suspension of barium sulphate 50 parts and arachis oil 50 parts is effective. If a bronchial fistula is present, a thicker suspension must be used which will not enter the bronchial tree; barium sulphate 50 parts and 25 parts each of arachis oil and liquid paraffin is a suitable formula. Before the radiographs are taken the

drainage tube should be replaced by a strip of sterilised leaded rubber of the same length; this will show the relationship of the tube to the cavity.

After operations on the lung such as lobectomy and pneumonectomy, there is usually an effusion of blood and exudate which tends to become loculated owing to the formation of fibrous septa. Penetrating films taken in the postero-anterior and lateral positions are of value in localising these pockets before they are aspirated.

279

MASS RADIOGRAPHY IN WOMEN : A Review of 30,000 Examinations

by F. T. Clive, *Tubercle*, **24**, 63–67, April 1943

The subjects of this investigation were all recruits for the Women's Auxiliary Air Force who had previously passed a thorough clinical examination, and this may account for the relatively small number of tuberculous cases discovered. 525 (1·75 %) of the 30,000 women showed radiographic evidence of pulmonary tuberculosis and 102 of these had active lesions. Comparing the results of this survey with those obtained by Trail (1942) in an examination of men of the Royal Air Force it is suggested that between the ages of 17 and 20 active tuberculosis is twice as common in women as in men. Inactive lesions become more numerous as the age of the subjects advances, showing that the disease must often heal spontaneously. The total incidence of tuberculous lesions in the lungs is one-third higher in women than in men when all age groups are considered. Of the 102 subjects with active tuberculosis, 14 gave a family history of tuberculosis and 29 had symptoms. In as many as 64 cases, no significant history of any kind was obtainable. In 52, the disease was early and small in extent; in 66, abnormal physical signs were detected and in 18 the sputum contained tubercle bacilli.

The most common non-tuberculous lesions were pneumonia and shadows due to catarrhal infections (13 cases). Various congenital abnormalities were discovered; 32 (0·11 %) subjects had a lobe of the azygos vein and no less than 147 (0·49 %) had a cervical rib.

The author concludes that, in any mass radiological survey of women, about 3 % of the subjects will require further examination with a full size *x*-ray film, and 4 women out of every 1,000 will require immediate hospital treatment. As an indication of the effect of preliminary selection by a strict physical examination the incidence of active tuberculosis in this series, 0·3 %, may be compared with the incidence of 0·63 % reported by Banszky (1942) in a survey of unselected factory workers.

REFERENCES

Banszky, L. (1942) *Lancet*, **2**, 693

[1] Trail, R. R. (1942) *Lancet*, **2**, 413

[1] [*see BMB* **43**]

280

TUBERCULOSIS SURVEY AT A MENTAL HOSPITAL BY MINIATURE RADIOGRAPHY

by W. E. Snell, J. F. MacMahon & F. R. G. Heaf, *Lancet*, **2**, 636–638, 20/11/43

These writers examined 2,035 patients and 224 staff at *Leavesden* Mental Hospital by miniature radiography. Exhaustive clinical and pathological examination of suspects was undertaken. Thirty-six apparently new cases of pulmonary tuberculosis were detected. In addition 87 cases, including 37 with widespread calcification, seemed to have inactive lesions. The total incidence of tuberculosis was estimated at 6 %, of which 2 % were active. The type of pulmonary tuberculosis demonstrated was of interest. Most of the patients were suffering from congenital mental defects, and were leading an inert, vegetative existence, with depression of motor activity, including respiratory movements and the cough reflex. In many, the disease process seemed to follow a subclinical and comparatively benign course, with spontaneous cure. The lack of symptoms, rareness of cavitation and frank hæmoptysis, the negative bacteriology and the incidence of widespread calcification support this view.

From their findings, the writers demonstrate that asymptomatic cases of pulmonary tuberculosis can be detected by chest *x*-ray examination. Although the miniature *x*-ray film proved its value, the routine use of 15 × 12 inch [about 38 × 30 cm.] films would normally seem to be preferable in the case of difficult groups of patients such as those described above; a possible alternative is the 5 × 4 inch [about 13 × 10 cm.] mass-radiography unit for large-scale surveys of mental patients.

281

PRIMARY ATYPICAL PNEUMONIA

by W. R. M. Drew, E. Samuel & M. Ball, *Lancet*, **1**, 761–765, 19/6/43

The term " atypical pneumonia " is used to denote pneumonic consolidations other than those caused by any known virus, rickettsia, bacterium or chemical agent. The disease is not new, but the widespread use of radiography, for example in the Armed Forces, especially in influenza-like conditions, is leading to its more frequent recognition. The seasonal incidence of atypical pneumonia differs from that of pneumococcal pneumonia. November, February and March have been noted as the peak months, and its incidence corresponds with that of infections of the upper respiratory tract and the bacterial pneumonias. Young persons are particularly susceptible and the disease spreads by droplet infection. Fatal cases are rare and the pathology has not been studied extensively.

The lesions seem to consist of an interstitial pneumonia and bronchitis with adjoining areas of collapse, consolidation, and emphysema with muco-purulent exudate in the bronchi. Interstitial infiltration with mononuclear cells is a constant finding. The leucocyte count is normal or slightly raised with a relative increase in the mononuclear cells. The erythrocyte sedimentation rate is raised and the sputum contains mononuclear cells in addition to the normal bacterial flora.

The ætiology of atypical pneumonia is unknown but similar pulmonary lesions can be produced in animals by many viruses. In particular the physical, radiological, and pathological findings in pulmonary psittacosis are identical with those of atypical pneumonia and patients with the latter have shown blood antibody responses similar to those found in psittacosis. Andrewes & Mills (1943) have shown that psittacosis is commonly found in pigeons in Britain, and the fact that atypical pneumonia usually affects young people may account for its severity being less than that of psittacosis in older subjects. Attempts to find a relationship between the influenza virus and atypical pneumonia have failed, but similar pulmonary lesions are found in some rickettsial diseases.

The authors describe 50 cases of atypical pneumonia occurring in Service personnel. The onset was usually gradual and was marked either by headache, malaise and aching limbs or by coryza, a painful throat, and retrosternal soreness. Cough usually developed in from 2 to 5 days. The headache was sometimes so severe that it resembled meningitis. The sputum was muco-purulent and not blood-stained, although small frank hæmoptyses occurred in 3 cases. Pain in the chest on the side of the lesion was fairly common; it was usually continuous and not pleuritic. Dyspnœa and cyanosis were uncommon; there was often a relative bradycardia. Most patients had a pyrexia of 100° to 102° F. [about 38° to 39° C.] which subsided in 7 to 10 days, but some were afebrile throughout. Pharyngitis was common, but there were often no abnormal physical signs in the chest. The average duration of the disease was 33 days and complications such as encephalitis and otitis media were rare.

No relationship was observed between the severity of the clinical findings and the size of the radiological lesion. The lesions were commonly found in the lower lobes and varied in size, rarely involving a whole lobe. In 6 cases the disease was bilateral. The usual radiological finding was an opacity of variable size and indefinite outline, sometimes having a reticulated appearance; the hilar glands were usually enlarged. The lesions can simulate those of acute tracheobronchitis, tuberculosis, abscess or resolving pneumococcal pneumonia, especially after inadequate sulphonamide therapy. A small area of bronchiectasis with surrounding consolidation can give a similar picture. All these conditions must be

considered in the differential diagnosis. There is no specific treatment; the patient should be confined to bed during the acute phase. Drugs of the sulphonamide group have no effect on the course of the disease and should not be used.

REFERENCE

Andrewes, C. H. & Mills, K. C. (1943) *Lancet*, **1**, 292

Tuberculosis in Children

282

CHILDHOOD INFECTION AND ITS RELATION TO ADOLESCENT AND ADULT PULMONARY TUBERCULOSIS

by A. M. Macpherson, *British Medical Journal*, **2**, 98–101, 24/7/43

This is the eighth of a series of reports published by the Research Department of the *Brompton* Hospital during the past 14 years, and it consists of a summary of the previous reports, together with some conclusions which may be drawn from them. The references to the earlier reports are given at the end of this abstract.

Report I (1930) was based on an analysis of the mortality rates from tuberculosis in children in England and Wales between the years 1898 and 1927. It showed the increasing incidence of young adult tuberculosis, although the general mortality from tuberculosis in childhood was improving. In families attending the *Brompton* Hospital, it was found that there was a definitely increased mortality rate from tuberculosis among children under 5 who were living in contact with relatives with a positive sputum.

Report II (1931). During the years 1930 and 1931, 1,220 children were tuberculin-tested and were divided into two groups, (i) those who were known to have been exposed to tuberculosis and (ii) those with no history of contact. The number of positive reactors was almost twice as great in the contact as in the non-contact group. Under the age of 5 years the difference was even more striking, the number of positive reactors being 5 times greater in the contact than in the non-contact group.

Report III (1932). *X*-ray examination of the tuberculin-positive reactors showed that tuberculous pulmonary lesions of the adult type were rare in children.

Report IV (1933). Re-investigation of some of these children after 1½ to 2 years showed that, whereas the contact children acquired a high degree of tuberculin sensitivity at an early age, the non-contact children did not reach this degree of allergy during childhood.

This work was continued over a number of years and included serial radiography of the children who showed lesions. Finally it was possible to form a fairly complete picture of primary tuberculosis of the lungs in childhood (*Report VII*, 1939). The condition was usually symptomless and healed spontaneously in most cases. Enlargement of the hilar lymph glands sometimes produced complications such as atelectasis. Tuberculous meningitis occurred in a few cases, and there was a striking relationship between the incidence of childhood tuberculosis and exposure to infection.

The occurrence of primary infections in childhood was considered to be a much less serious matter than the high incidence of tuberculosis in young adults, and a separate investigation of this problem has been in progress since 1936. It was noticed that, as the children grew into adolescence, lesions of the adult type began to appear in the lungs. These lesions were usually small and single, often situated at the apex, and rarely gave rise to any symptoms. They showed a tendency to spread and seldom healed spontaneously if untreated, but it was often 3 to 5 years before the patient developed symptoms, and by that time a cavity was usually present. An analysis of 1,000 patients at *Brompton* Hospital who developed pulmonary tuberculosis between the ages of 15 and 25 showed a history of contact infection in 40 % (*Report VI*, 1936).

In the majority of instances the disease was far advanced before the patient sought treatment. It therefore seemed probable that these lesions started as the small, symptomless foci already observed in adolescents, and this view was confirmed by a radiological survey of 2,381 young people between 14 and 21 years old (*Report V*, 1936). This was the first mass radiographic survey to be carried out in Great Britain, and it showed an incidence of pulmonary tuberculosis of 0·65 %. Comparison of this figure with the official figures for the incidence of tuberculosis in the general population (0·4 % to 0·75 %) suggested that the majority of these symptomless infected adolescents must eventually break down and develop extensive disease.

The treatment of a minimal lesion discovered by *x*-ray examination in the lung of an apparently healthy young person presents a difficult problem. This type of patient does not respond readily to rest and sanatorium treatment, as he is active and feels well, despite the fact that the lesion is slowly spreading. If he is allowed to lead a normal life, it is probable that the diseased area will become adherent and that cavitation will occur, thus reducing the chances of successful treatment.

It is suggested, therefore, that a shallow artificial pneumothorax should be tried as the treatment of choice for controlling a symptomless but progressive tuberculous lesion in the lung of an adolescent. This provides rest for the affected lung and also ensures that the patient is kept under regular observation.

Many such patients have returned to their school or work within a few days of the induction of the pneumothorax and have remained well. It should not be necessary to maintain the collapse for more than 2 or 3 years. The results of this treatment have yet to be seen, but it is advanced as an alternative to other methods such as prolonged rest and sanatorium routine which have proved unsatisfactory and impracticable in cases of this type.

REFERENCES

Report I: Lloyd, W. E. & Dow, D. J. (1932) *Brompton Hosp. Rep.* **1**, 20

Report II: Lloyd, W. E. & Dow, D. J. (1931) *Brit. med. J.* **2**, 183

Report III: Lloyd, W. E. & Dow, D. J. (1932) *Brit. med. J.* **1**, 701

Report IV: Lloyd, W. E. & Macpherson, A. M. (1933) *Brit. med. J.* **1**, 818

Report V: Wingfield, R. C. & Macpherson, A. M. (1936) *Brit. med. J.* **1**, 741

Report VI: Lloyd, W. E. & Macpherson, A. M. (1936) *Brit. med. J.* **2**, 1131

Report VII: Macpherson, A. M. (1939) *Brit. J. Tuberc.* **33**, 79

283

TUBERCULOSIS IN CHILDREN

by J. C. Roberts, *Lancet*, **2**, 2–4, 3/7/43

This analysis of 100 consecutive cases at the *Middlesex County* Sanatorium, Harefield, illustrates some of the clinical features and sequelæ of tuberculosis in infants and children. Fifty were found to have a primary complex in the lung, more commonly on the right side. Thirty-five of these had symptoms, the commonest being cough, fever, malaise, lassitude, loss of weight and gastro-intestinal upsets. Erythema nodosum was noted in 5 cases. Perifocal infiltration of the lung around the primary lesion was often well marked, and in other cases there was pulmonary collapse due to bronchial obstruction by the enlarged glands (epituberculosis). In some cases the parenchymal infiltration in the lung had spread and there was cavity formation.

Of the patients who did not have radiological evidence of a primary complex in the lung, 14 had pleural effusions, 8 had pulmonary tuberculosis of the adult type, 7 had cervical adenitis, and 3 showed signs of tuberculous peritonitis. The lesions of the adult type responded well to collapse therapy.

The author emphasises that the occurrence of a primary complex in a child usually causes symptoms; it should be recognised and treated carefully in an institution. The importance of careful and repeated examination of children who are known to have had contact with an infected adult is also stressed. There was a history of such contact in 60 % of this group of tuberculous children.

284

INCIDENCE AND TREATMENT OF TUBERCULOSIS IN CHILDREN

by G. B. Fleming, *Lancet*, **2**, 580–581, 6/11/43

It is not generally recognized that, in children dying of tuberculosis, by far the most usual route of infection is through the respiratory tract. The majority of children become infected with tuberculosis, but only a small proportion of these under one year old give a positive Mantoux reaction ; as age increases, however, positive skin reactions become more and more frequent, so that at the age of twelve 50 %, and at twenty 70 % are positive. The incidence of tuberculous meningitis, the usual cause of death in such cases, falls with increasing age. The present paper, from the Department of Pædiatrics, University of Glasgow, and the Royal Hospital for Sick Children, Glasgow, reports that of 326 children dying of tuberculous meningitis, 70 % were under four years old, while of 322 over seven years of age only 5 % died. The writer makes the important points that (*a*) the majority of children are infected from a human source, and (*b*) the younger the age at which infection takes place, the greater the risk. Young children should be protected from infection. Those giving a positive tuberculin skin reaction should be removed to suitable surroundings and kept under observation for six months.

Social and Statistical Aspects of Tuberculosis

285

TUBERCULOSIS IN PEACE AND WAR

by A. S. MacNalty, *Tubercle*, **23**, 263, December 1942

This paper, the author of which was until recently Chief Medical Officer to the Ministry of Health, contains a survey of the development and present position of tuberculosis services in Britain. In 1841 the *Brompton* Hospital was founded, in London, for the treatment of the tuberculous. In 1887 Sir Robert Philip started at Edinburgh the first Tuberculosis Dispensary or clinic for tuberculous patients who were not confined to bed. In 1912 the National Tuberculosis Service was established. Under this scheme each County Council, or County Borough Council, undertook to provide treatment for all forms of tuberculosis in its area, and dispensaries, sanatoria and hospitals were set up for this purpose. The scheme had only just started when, in 1914, war was declared.

The British Isles suffered less from direct enemy action than in the present war, but, even so, the tuberculosis death rate rose from 988 per million in 1914 to 1,498 per million in 1918. This was largely due to overcrowding and lowering of resistance through physical and mental strain ; long hours of work in munition factories and a lowered standard of nutrition also contributed. In addition, the Tuberculosis Service was restricted owing to shortage of medical staff and restrictions on the building of sanatoria.

The years of peace following 1918 were remarkable for many advances in the treatment of tuberculosis in Britain. These included the rise of thoracic surgery, improved radiological technique, and the foundation of Village Settlements. At the outbreak of the present war the mortality from all forms of tuberculosis in Britain was declining, and this improvement was steadily maintained year by year and was especially marked among the young adult population.

Since 1939 the expected war-time increase in tuberculosis has taken place ; the mortality rate rose from 26,250 in 1939 to 28,619 in 1941. It has been calculated that the increase amounted to 6 % in the first year and 10 % in the second year of the war, and there has been a serious rise in the mortality from tuberculous meningitis.

There are many factors to account for these figures. Mass radiographic surveys in the Fighting Services[1] have shown that 1·3 % of Naval personnel and 1·74 % of Army personnel have radiological evidence of pulmonary tuberculosis, while about 0·3 % have active disease. At the outbreak of war, evacuation from the cities tended to spread the tuberculous population into other areas where there were not adequate means for treating them. Many hospitals have been bombed. An acute shortage of nurses has developed owing to the great demands of the Services and of industry, and this has caused a reduction in the beds available for the treatment of tuberculosis. Overcrowding has occurred both in air raid shelters and in homes owing to black-out conditions ; this probably also accounts for the increase of tuberculosis in mental hospitals. These are the chief reasons for the spread of tuberculosis during the present war.

Great efforts are being made to check this process. Lack of protective foods, fruits, vegetables, cheese, eggs and milk, may lower the general resistance in war time, and the diet is therefore being carefully planned. Milk supplies are being watched, particularly with regard to the control of infected cattle and pasteurisation of milk. Attempts are being made in factories to control the factors which lead to an increase in tuberculosis : these are overcrowding, employment of the unfit, employment of those unused to manual work, fatigue and deficient ventilation.

The author advocates the adoption of the following immediate measures for the prevention and treatment of tuberculosis :

i. The widespread use of mass radiography, particularly in industry, in order to facilitate early diagnosis. This is already being undertaken by the Ministry of Health.

ii. The provision of more hospital and sanatorium beds for the treatment of patients diagnosed by mass radiography.

iii. The development of Village Settlements. Such Settlements provide expert treatment for all forms of tuberculosis and work for those patients who are capable of it. They also provide the patient with a normal community life while segregating him from the general population. During the 25 years since the founding of the first Settlement by the late Sir Pendrill Varrier-Jones at Papworth, *no child born at the Settlement has contracted tuberculosis while living there.* This proves conclusively that spread of the disease can be prevented under the conditions which prevail in a Settlement. These include proper hygienic precautions, adequate food, good housing, absence of anxiety, freedom from strain and the risk of unemployment, prompt treatment of relapses, and continuous medical supervision. Four Settlements of this type are already in existence, more are needed, and this kind of rehabilitation for the tuberculous should also be extended by the provision of special workshops where workers can be kept under medical control.

286

THE COMPREHENSIVE ATTACK ON PULMONARY TUBERCULOSIS

by A. S. MacNalty, *British Medical Journal*, **2**, 599–601, 13/11/43

This is the second Memorial Lecture to Sir Pendrill Varrier-Jones, founder of the Papworth Village Settlement for the tuberculous. The author enunciates certain principles for the guidance of the physician in the appropriate use of hospitals and sanatoria, and in the selection of tuberculous patients for different forms of treatment. At Papworth the tuberculous subject remains under constant medical, psychological and social supervision.

A greater incidence of pulmonary tuberculosis is to be expected at the end of the present war, and the Ministry of Labour has inaugurated a Scheme for Training and Resettlement of Disabled Persons, in which certain types of tuberculous subjects are included. In outlining the pioneer work of Varrier-Jones, MacNalty records what is being done by the Government towards the rehabilitation of the tuberculous after the war and indicates the lines upon which further development is an urgent necessity.

287

RESPIRATORY TUBERCULOSIS : Effect of the War on the Length of the Interval between Notification and Death

by E. Lewis-Faning, *British Medical Journal*, **2**, 684–685, 27/11/43

In areas of England and Wales generally, the level of mortality from pulmonary tuberculosis in 1940–1941 was higher than in the years immediately preceding the war. In this report an attempt is made to measure to what extent the excess—at least in the administrative county of Middlesex—was due

[1] [*For the results of such a survey in the Royal Air Force, see BMB* **43**.]

to a shortening of the duration of the disease brought about by lowered resistance in those already infected.

At all ages combined it was found that deaths occurring from pulmonary tuberculosis in the three pre-war years 1937–39 and in the two war years 1940–41 were distributed according to the interval between notification and death in the following proportions:

Interval in years	Males				Females			
	1937–39		1940–41		1937–39		1940–41	
		%		%		%		%
Under 1	541	43	398	42	384	41	303	46
1 —	561	44	390	41	426	46	275	41
5 +	169	13	156	17	120	13	88	13
All durations	1271		944		930		666	

No statistically significant change in the percentage dying in the duration-groups in the two periods can be demonstrated for either sex. It is argued that if lowered resistance due to the war had brought about some increase in mortality in 1940–41 from the death in those years of patients who otherwise might have lived to 1942 or later, some disturbance in the percentages would have appeared. (No change would occur had such an increase been equally effective at each duration-group, but this is a highly improbable supposition.)

The analysis was applied not only to deaths at all ages combined, but to the deaths in age-groups. The results when tested statistically were inconclusive, but suggested a small increase in the proportion of patients dying with durations of the disease of five years and over, accompanied by a decrease in the proportion with durations of one to five years.

The author makes a comparison between the pre-war and war years as regards the *average length of duration* in age-groups. No differences greater than might be expected from the play of chance were found and he concludes that " the analysis produced no conclusive evidence of any appreciable decrease in the average length of time between notification and death in the two years following the outbreak of war."

A word of caution should perhaps be given against accepting this result for Middlesex as generally applicable to other areas of England and Wales. The number of deaths per annum studied is relatively small and for larger areas, aggregates of areas, or industrial areas, significant differences might appear which would warrant contrary conclusions. However that may be, the work is valuable if only that it satisfies a long-felt need by supplying some indication of the pre-war distribution of deaths from pulmonary tuberculosis according to duration of disease.

288

SURVIVAL RATES IN PULMONARY TUBERCULOSIS

by B. C. Thompson, *British Medical Journal*, **2**, 721, 4/12/43

This paper is a continuation of earlier work (Thompson, 1942) on survival rates of tuberculous patients with positive sputum, in the county of Durham. It might perhaps have been stated that the initial investigation covered a period when housing was being condemned and replaced under Slum Clearance Orders, when chronic unemployment prevailed and mines were completely closed down, so that economic depression was general and family incomes were low.

The original material consisted of 406 patients, all over 10 years of age, with pulmonary tuberculosis with positive sputum notified in the Chester-le-Street tuberculosis dispensary area of the county of Durham, during the years 1928–1938 inclusive. The histories of these patients were traced from the date of diagnosis at the dispensary until either the anniversary of that date in 1941, or until the death of or loss of contact with the patient, whichever occurred first.

In this later article the *same* 406 patients have been traced wherever possible to the anniversary of diagnosis in 1943, an additional two years. Clearly, those entering the experience in 1938 can now have been followed up for five years, originally for only 3.

By utilising the life-table method the probabilities (i) of dying each year after diagnosis, (ii) that having survived a given number of years the patient would survive a further five years, were calculated. The results of the extended analysis confirm and amplify the original.

Of 100 sputum-positive patients, 40 die within a year of diagnosis. Little more than a quarter remain alive at the end of five years and about an eighth at the end of ten years. There is an even chance that patients who survive the first five years will not live another five years, but it may be safely considered that those who do have made a sure recovery. Those within age-group 30–39 have the most favourable chance.

REFERENCE

Thompson, B. C. (1942) *Tubercle*, **23**, 139

289

TUBERCULOSIS IN LONDON

by W. A. Daley & B. Benjamin, *British Medical Journal*, **2**, 712–713, 4/12/43

During the period between the two world wars, both the incidence and mortality from pulmonary and non-pulmonary tuberculosis in the administrative county of London steadily declined, as judged by the trend of notification and death rates. Following the outbreak of war in 1939 the decline gave place to an increase. In this paper the authors have extended their previous study (Daley & Benjamin, 1942) of that change by the addition of figures for 1942. The results show a definite contrast between children and adults.

At ages under 15 the notification rate, which in 1941 was about three times the 1938 level, fell to approximately only twice that figure. The death rate, which in 1941 was about 400 % higher than 1938, fell in 1942 to nearly the pre-war level. The numbers involved at these ages are small, and too much significance should not be attached to the results. A similar picture is presented as regards non-pulmonary tuberculosis.

Amongst adults, on the other hand, the incidence continued to increase in 1942. Mortality declined slightly for the pulmonary, but increased for the non-pulmonary type. The notification rate in 1941 for pulmonary tuberculosis was 124 % of the 1938 figure; in 1942, 130 %. Death rates fell from 151 to 136 % for pulmonary, but increased from 150 to 167 % for non-pulmonary cases. It is considered possible, as pointed out by Stocks (1942), that any decline in mortality found in 1942 may be only temporary.

Discussing the contrasts shown between children and adults, the authors suggest two reasons for the lower incidence found in 1942 amongst children. First, that the return from evacuation areas of healthy children reduced the proportion of tuberculous to the total number of children in the County of London, and secondly that the substantial reduction of living in air-raid shelters had a beneficial influence. The continued increase in incidence amongst adults, it is suggested, is associated with the undiminished pressure of war production, the effects of black-out on ventilation, and the shortness or lack of holidays.

REFERENCES

Daley, W. A. & Benjamin, B. (1942) *Brit. med. J.* **2**, 417

Stocks, P. (1942) *Brit. med. J.* **2**, 750

BOOKS, MEMORANDA, REPORTS

[The prices quoted are those which obtain within the United Kingdom. Editors of medical journals who wish to review publications of which notices appear below are invited to apply to the Editor for review copies, of which a few are sometimes available.

Orders for any of the publications mentioned below may be sent to BES Ltd., 6 Hanover Street, London, W. 1, England, if there are difficulties in obtaining them locally. It should be noted that supplies of all publications are limited and there can be no certainty that publications ordered or requested for review will be available.]

290/1

MASS MINIATURE RADIOGRAPHY

by R. R. Trail, H. G. Trenchard & J. A. Kennedy. London, J. & A. Churchill, 1943. 96 pages ; 24 illustrations. 8s. 6d. [£0.425]

The authors of this little book write from a large practical experience of mass examination of the chests of Royal Air Force personnel. The setting up and administration of a mass miniature radiography department are discussed and the necessity for the high technical quality of the miniature radiograph is emphasized. Accommodation, apparatus, lay-out and staff, records and the disposal of suspects are other matters carefully dealt with, and there are sections devoted to the interpretation of films, classification, record cards and accessory equipment. The book appears at a time when mass radiography centres are being organized throughout Britain. It should be of value in the organization and running of such centres.

290/2

CHEST EXAMINATION : The Correlation of Physical and X-ray Findings in Disease of the Lungs

by R. R. Trail. London, J. & A. Churchill, 1943. 107 pages ; illustrated. 10s. 6d. [£0.525]

The main purpose of this book is to correlate the anatomy and pathology of the lungs with the physical findings—clinical and radiological. There is a summary of the anatomy and normal radiological appearance of the lung, a section correlating the abnormal physical and radiological findings in common chest diseases with the pathology, and some notes on physical signs and on reading films of abnormal chest conditions.

290/3

THE RADIOLOGICAL APPEARANCES OF EARLY PULMONARY TUBERCULOSIS. Ministry of Health Memorandum No. 268

by R. R. Trail & P. Kerley. London, H.M.S.O., 1943. 8 pages. 2d. [£0.008]

The memorandum has been written jointly by a chest physician and a radiologist. In a short introductory note, Sir W. Wilson Jameson, Chief Medical Officer to the British Ministry of Health, refers to the need created by the development of mass radiography for a standard technique and the systematic study of abnormal radiographical appearances. In the first two pages, the essentials of a good postero-anterior radiogram of the chest are defined and the necessary equipment and technique are discussed. The remainder of the memorandum is devoted to a description of the varying radiological appearances in early pulmonary diagnosis. This section is illustrated by 21 small diagrams.

290/4

CARE OF TUBERCULOSIS IN THE HOME

by J. Maxwell. London, Hodder & Stoughton, 1943. 105 pages. 7s. 6d. [£0.375]

This is a résumé of the essential points about tuberculosis and its effect on the social life of the patient, for whom it is written. The writer recommends that each step in treatment be explained to the patient, who should learn to control his own life and retain a healthy attitude towards his disease. There are chapters on the nature, symptoms and treatment of tuberculosis, on hygiene and prevention, and advice on occupation, marriage and diet. This book should prove a helpful guide to the tuberculous patient, both during his illness and on his return to working life, and also to the general practitioner who shares responsibility for his care.

290/5

MEDICINE IN BRITAIN

by H. Clegg. London. Published for the British Council by Longmans, Green & Co., 1943. 46 pages ; 7 illustrations. 1s. [£0.05]

If even the informed foreign observer is often unable to discern a coherent pattern in the multiform edifice of British Medicine, it must be conceded that there is good reason for his difficulty. The multiplicity of medical degrees and diplomas, and of agencies concerned directly or indirectly with medical education and with the promotion of health in the school, in the home and in the factory, may sometimes seem to defy rational interpretation. In this book, British Medicine is compared to a network of English country roads. It might as aptly be compared to a large old house, to which, in response to the changing needs of successive generations, have been added bathrooms, electric light, central heating and, at different periods, modern structural extensions.

Dr. Clegg has succeeded brilliantly in his difficult task of surveying British Medicine and explaining the evolution and purpose of its parts. His small book contains a wealth of authoritative information which is presented in the easily readable style of a natural writer. The function and character of the General Medical Council, the Medical Corporations (of which the Royal Colleges of Physicians and of Surgeons are examples), the Medical Research Council, the Ministry of Health, the British Medical Association, the " Voluntary " Hospitals, and other important institutions are clearly explained in the light of their historical development. The essential facts about National Health Insurance, industrial medicine, the tuberculosis services, the Indian and Colonial Medical Services, and such wartime developments as the Emergency Medical Services and the Emergency Public Health Laboratory Service are included.

Although the final impression on the reader is one of cumulative progress, there is now in Britain an almost unanimous recognition of the need for substantial changes in the organisation of the medical services. Dr. Clegg's last chapter is a useful short statement of the differing views of the profession on this important question.

A " white paper " containing the proposals of the Ministry of Health for the future of British Medical Services has just been published by the British Government. These proposals will be freely discussed, and the medical profession will expect and has been promised ample opportunity for their consideration and criticism. As an aid to the understanding of the coming discussions of British medical services, " Medicine in Britain " should be invaluable. It should also be an indispensable handbook to the overseas medical visitor to Britain, or to medical men in other countries who wish to acquire without undue effort an integrated conception of British Medicine at a moment when it is at the threshold of great changes.

290/6

RECENT ADVANCES IN MEDICINE

by G. E. Beaumont & E. C. Dodds. 11th edition. London, J. & A. Churchill, 1943. 18s. [£0.9]

This well-written survey of recent medical progress, the pioneer of the " Recent Advances " series, has attained its eleventh edition in nineteen years. The new edition has been enriched by the addition of new material on penicillin, the sulphonamides and vitamins, blast injuries of the lungs, " acid " phosphatase, plasma protein regeneration and amino-acid therapy, the blood groups, the Rh factor, the dangers of blood transfusion, and thymectomy in myasthenia gravis. Methods for sulphonamide estimation in blood and urine are given, and additional notes are made on the treatment of hæmatemesis and on the use of the continuous intragastric drip for certain types of peptic ulcer. The sex-hormone chapter has been revised, and additions to the kidney chapter include descriptions of the specific gravity and inulin clearance tests, the compression syndrome, and the dangers of mercurial diuretics. As in earlier editions, the book is liberally supplied with references to recent literature, and it will prove especially valuable to the physician who wishes to keep abreast of the most recent developments of clinical and laboratory medicine.

290/7

FRACTURES AND JOINT INJURIES

by R. Watson-Jones. Third Edition. 2 vols. Edinburgh, E. & S. Livingstone, 1943. 960 pages ; 745 illustrations. £3 15s. [£3.75]

This is one of the most important books on the subject which has appeared in the English language, and it should be of the utmost value, not only to the orthopædic surgeon, but to the general practitioner who is called upon to treat bone and joint injuries. The book reveals the writer's talent for teaching and for original and stimulating presentation of his matter ; the illustrations are many and are of an extremely high standard, and it is evident that much thought has been devoted to their selection. This comprehensive work includes sections on open and infected fractures and war wounds, chemotherapy and the closed plaster technique. The subject of rehabilitation, of which the author has been a pioneer, is also fully covered. Amputations and their indications are carefully dealt with. The writer, who is Consultant in Orthopædic

Surgery to the Royal Air Force and a member of the War Wounds Committee of the Medical Research Council, has been intimately concerned with developments in his subject during the present war.

290/8

THE SURGERY OF REPAIR : INJURIES AND BURNS

by D. N. Matthews. Oxford, Blackwell Scientific Publications, 1943. 386 pages ; 198 illustrations. £2 5s. [£2.25]

This book deals with the treatment of the common war injuries which come within the province of the plastic and maxillo-facial surgeon. Orthopædic surgery is not considered, but the routine immediate treatment of thoracic and abdominal perforating wounds is included because these injuries frequently complicate plastic and maxillo-facial cases in wartime. The methods and treatment described are those used by the author, who has had considerable experience of the subject as Surgical Specialist to the Royal Air Force Voluntary Reserve and Surgical Officer in Charge, Royal Air Force Plastic Unit. Part I of the book deals with shock, crush injury, chemotherapy, anæsthesia, the surgery of wounds, nerve and tendon suture, abdominal and thoracic injuries ; part II describes late repair, including scar excision and skin transplants, and nerve and tendon injuries ; part III discusses the repair of facial injuries, and includes descriptions of operations for dealing with the nose, lips, eye, cheek, etc. ; and part IV is an adequate summary of the treatment of burns.

291

GUIDE TO THE JOURNALS

British Journal of Industrial Medicine

1 : January 1944

The evolution of an industrial society. (M. Greenwood) 2–6
Some aspects of sick absence in industry. (H. H. Bashford) 7–10
Chronic carbon tetrachloride intoxication. (A. Stewart & L. J. Witts) 11–19
The investigation of toxic hazards. (M. W. Goldblatt) 20–30
Heating and ventilation : requirements and methods. (T. Bedford) 31–47
Nutrition and the industrial worker. (E. H. Capel) 48–53
Some foot faults related to form and function. (W. S. Creer) 54–61

British Journal of Radiology

17 : January 1944

The diagnosis, classification and treatment of tumours of the salivary glands. Symposium (R. T. Payne, M. C. Tod & M. Lederman) 3–12
Venous intravasation during utero-salpingography. (E. R. Williams) 13–17
Malignant tumours of the upper jaw. Part II. (B. W. Windeyer) 18–24
The time intensity factor in X-ray irradiation. (E. Paterson) 26–30
Salivary calculus or tartar. (A. S. Johnstone) 31–32

17 : February 1944

An enquiry into the causation and characteristics of cephalhæmatomata. (J. B. Hartley & C. W. F. Burnett) 33–41
Regression of tumours following treatment by stilbœstrol and X-ray therapy, with notes on a case of breast tumour which regressed with stilbœstrol alone. (G. G. Binnie) 42–45
A dosage system for linear gamma-ray sources. (D. E. A. Jones) 46–47
X-ray appearances in amœbic hepatitis. (J. Munk) 48–53
The nature and functions of the intervertebral discs. (Ff. Roberts) 54–59
Cholecystography : pheniodol as a medium for the Graham-Cole test. (G. T. Calthrop) 60–61

British Journal of Surgery

31 : January 1944

The Anglo-American Canadian surgical mission to Russia, July, 1943. (G. Gordon-Taylor) 205–207
Military surgery in the "Middle East." (A. E. Porritt) 208–221
Compound fronto-orbital fractures : eight cases. (J. Schorstein) 221–230
Recurrent hernia : an investigation of the causes of recurrence and the application of the principles of treatment of the primary lesion. (W. Patrick) 231–239
A case of cerebrospinal fever with thrombosis of the right axillary artery, followed by gangrene of the right arm, necessitating amputation. (A. Levin & D. M. McElroy) 240–242
Humero-radial synostosis. (E. Frankel) 242–245
Spinal anæsthesia in the treatment of Hirschsprung's disease : with reports of twelve cases. (M. Hawksley) 245–252
Fractures and dislocations of the cervical spine. (F. Crooks & A. N. Birkett) 252–265
On severe intestinal hæmorrhage due to myomatous tumour of the jejunum : with a note on bleeding myomata of the small intestine. (G. Gordon-Taylor) 266–269
Multiple cavernous hæmangiomas of the lungs successfully treated by local resection of the tumours. (R. M. James) 270–272
Congenital dislocation of the shoulder. (G. Flavell) 272–275
Mesenteric defects. (E. G. Dolton) 275–277
Fractures of the triquetrum. (J. G. Bonnin & W. P. Greening) 278–283
Ureteral stricture with perinephric urinary extravasation, caused by metastases from a silent carcinoma of the stomach. (J. D. Fergusson) 283–286
The surgical aspects of sulphapyridine anuria. (J. M. Campbell) 286–288
Post-operative respiratory complications following unilateral inguinal herniorrhaphy in war time : a study of 438 service cases. (B. G. B. Lucas) 288–291
Healing of experimental wounds of lung. (G. L. Montgomery) 292–299

British Medical Journal

1 : 1/1/44

The nature of concussion. (G. Jefferson) 1–5
Nutritional deficiency in the pathogenesis of disease. (J. Yudkin) 5–7
The prisoner-of-war mentality : its effect after repatriation. (P. H. Newman) 8–10
A case of aspirin poisoning. (A. D. Charters) 10–11
Prostigmin in the treatment of delayed period. (E. Friedmann) 11–12
The chronic medical case in the army. (J. W. Todd) 19–20

1 : 8/1/44

Gunshot wounds of the head in the acute stage. (H. Cairns) 33–37
Burns and scalds in children : an investigation of their cause and first-aid treatment. (A. W. Wilkinson) 37–40
Heat in the treatment of shock. (A. W. Kay) 40–41
Influenza "A" : an account of a minor epidemic. (T. H. Donnelly, H. P. Hughes, D. Robertson & E. Philipp) 42–43
Estimation of hæmoglobin by photo-electric absorptiometers. (J. M. Peterson & D. H. Strangeways) 43–44
The modern treatment of gonorrhœa in the female. (T. E. Osmond) 51–52

1 : 15/1/44

Clinical features and treatment of malaria in British troops in West Africa. (S. B. Hughes & R. R. Bomford) 69–73
Despeciated bovine serum (D.B.S.) : a substitute for human plasma. (F. R. Edwards) 73–76
Treatment of anæmia in school-children with iron and ascorbic acid. (L. S. P. Davidson & G. M. M. Donaldson) 76–77
The influence of supplements of vitamins A, B_1, B_2, C, and D on growth, health, and physical fitness. (E. R. Bransby, J. W. Hunter, H. E. Magee, E. H. M. Milligan & T. S. Rodgers) 77–78
Umbilical hernia in children : with special reference to injection treatment. (M. J. Bennett-Jones) 78–79

1 : 22/1/44

Emphysema of the lungs. (R. V. Christie) 105–108
Supervision of pregnant women in factory employment. (J. V. O'Sullivan & L. B. Bourne) 108–110
Five cases of jaundice following transfusion of whole blood or human plasma. (R. E. Steiner) 110–111
Histological effects of sulphonamide-proflavine mixtures in the rabbit : some experimental observations. (D. S. Russell & D. J. K. Beck) 112–113
Vaccination against typhus fever. (J. B. Penfold) 114
Treatment of pediculosis capitis. (E. Blackstock) 114–115

1 : 29/1/44

Localized subcutaneous œdema with weakness of limb muscles : a syndrome due to polyarteritis nodosa. (R. MacKeith) 139–142
Emphysema of the lungs. (R. V. Christie) 143–146
Infant feeding in relation to mortality in the city of Belfast. (J. Deeny & E. T. Murdock) 146–148
An unusual case of cerebral malaria. (C. S. D. Don & P. F. Meyer) 149
Effects on rats of prolonged feeding with the staple African diet. (J. Gillman) 149–150

1 : 5/2/44

Some principles of reform in medical education. (F. M. R. Walshe) 173–176
Pethidine as an obstetric analgesic : a report on 150 cases. (B. Gallen & F. Prescott) 176–179
Obstetric analgesia with pethidine. (W. Spitzer) 179–181
Bone marrow as a site for the reception of infusions, transfusion, and anæsthetic agents ; a review of the present position. (H. Bailey) 181–182
Staphylococcal septicæmia treated with sulphadiazine. (H. B. Norman) 183
Spontaneous rupture of abnormally mobile spleen. (J. Dubash & G. F. Langley) 183–184

1 : 12/2/44

Studies on hepatic dysfunction. I. Carbon tetrachloride poisoning. (J. Beattie, P. H. Herbert, C. Wechtel & C. W. Steele) 209–211
A clinical evaluation of some tests of liver function. (G. Higgins, J. R. P. O'Brien, A. Stewart & L. J. Witts) 211–215
Some uses for dry cold therapy, and a proposed cooling cabinet. (W. G. Bigelow & E. C. G. Lanyon) 215–217
Ætiology of "immersion foot." (B. W. Goldstone & H. V. Corbett) 218–219
External prophylactic version (M. B. Trubkowitch & B. A. Archangelsky) 220

Edinburgh Medical Journal

51 : January 1944

Localised arterial thrombosis of indeterminate origin. (J. R. Learmonth, W. Blackwood & R. L. Richards) 1–20
The protective diet. (R. Pybus) 21–38
The uses and abuses of the female sex hormones. (T. N. MacGregor) 39–55

Journal of Hygiene

43 : January 1944

Observations on an epidemic of paratyphoid fever in Dundee, 1941. (W. A. Davidson & J. Brodie) 219–228
Human pulmonary tuberculosis of bovine origin in Great Britain. (A. S. Griffith & W. T. Munro) 229–240
Diabetes mortality in 1861–1942 and some of the factors affecting it. (P. Stocks) 242–247
Concentration of the carcinogenic material in a Venezuelan spindle oil by simultaneous molecular distillation and chromatographic adsorption. (J. M. Twort & R. Lyth) 248–251
The prophylactic effect of a colloid material on the skins of mice painted with various types of carcinogenic agents. (J. M. Twort & R. Lyth) 252–255
Hæmolytic streptococci in the dust of hospital wards, and their relationship to infection. (D. G. F. Edward) 256–265
An agglutinogen common to certain strains of lactose and non-lactose-fermenting coliform bacilli. (Lord Stamp & D. M. Stone) 266–272
Some observations on accidental vaccinations on the hands of workers in a vaccine lymph institute. (E. S. Horgan & M. A. Haseeb) 273–274
Studies in the dynamics of disinfection. I. New data on the reaction between phenol and *Bact. coli* using an improved technique, together with an analysis of the distribution of resistance amongst the cells of the bacterial populations studied. (R. C. Jordan & S. E. Jacobs) 275–289

Lancet

1 : 1/1/44

Traumatic arterial spasm. (S. M. Cohen) 1–6
Reactive anxiety and its treatment. (G. Garmany) 7–9
Controlled external pressure and œdema formation. (R. J. Rossiter & note by R. A. Peters) 9–11
Late results of perforated peptic ulcer. (C. P. G. Wakeley) 11–12
Perforation of gastric and duodenal ulcers: a series of 312 cases. (S. C. Raw) 12–14
Perforated peptic ulcer during the period of heavy air-raids. (C. C. Spicer, D. N. Stewart & D. M. de R. Winser) 14
Continuous intravenous adrenaline in spinal anæsthesia for the control of blood-pressure. (F. Evans) 15–17
Unusual case of pellagra. (T. L. C. Henderson) 17
Kala-azar in an English seaman. (R. B. Thompson) 17–18

1 : 8/1/44

Sulphonamide dermatitis: sensitisation from local application. (B. C. Tate & I. Klorfain) 39–44
Gunshot wounds of the fronto-orbital region. (J. Schorstein) 44–47
Tender muscles in sciatica: electromyographic studies. (F. A. Elliott) 47–49
Phemeride: a new antiseptic detergent. (C. N. Bland) 49–51
Deposit in Seitz-filtered serum (G. E. C. Francis, G. A. Harrison & L. E. R. Picken) 51–52
Convulsions under anæsthesia treated by change of posture. (A. Smith) 52

1 : 15/1/44

Hand infections treated with penicillin. (M. E. Florey & R. E. O. Williams) 73–81
Rehabilitation of the chest case. (F. R. Edwards) 81–84
Some sensory effects of wounds. (H. Burrows) 84–85
Myelogenous leukæmia complicating pernicious anæmia. (P. B. Woolley) 85–86
Acute thyrotoxic bulbar palsy. (L. P. E. Laurent) 87–88
Orthopædic surgery and the future. (I. [illegible]tt) 95–97
Evolution of an information service: The Bureau of Hygiene & Tropical Diseases. (R. L. Sheppard) 97–98

1 : 22/1/44

Endemic goitre in England: argument for preventive action. (Memorandum of the Goitre Subcommittee, Medical Research Council) 107–109
Forward surgery in a battle period. (G. K. Harrison) 109–111
Intrapelvic rupture of urethra. (B. C. Murless) 111–112
Identity of patulin and claviformin. (E. Chain, H. W. Florey & M. A. Jennings; with a note on the crystallography by D. Crowfoot & B. Low) 112–114
Removal of ether vapour during anæsthesia. (H. G. Epstein) 114–116
Sciatica: a study of 40 cases. (A. D. Le Vay) 116–118

1 : 29/1/44

Psychosomatic casualties in the Middle East. (A. Torrie) 139–143
Trifin nail and plate for pertrochanteric fractures. (G. K. McKee) 143–145
Hæmolytic disease in the newborn: the Rh factor. (F. A. Langley & F. Stratton) 145–148
Diabetogenic action of alloxan. (H. Hughes, L. L. Ware & F. G. Young) 148–150
Notes on typhus fever in the Middle East. (W. Brockbank & S. R. F. Whittaker) 150–151
Portal pyæmia with recovery. (N. Alders) 151

1 : 5/2/44

Erythroblastic anæmia of childhood (Cooley's anæmia) in Cyprus. (A. L. Fawdry) 171–176
Postnasal swab in diagnosis of pertussis. (R. Cruickshank) 176–177
Apparatus for administering oxygen. (W. I. Card, W. J. Griffiths & B. A. McSwiney) 177–179
Thiourea causing granulopenia and thrombopenia. (P. B. Newcomb & E. W. Deane) 179
Vitamin-C nutrition in a hospital; with observations on a case of scurvy. (F. T. G. Prunty & C. C. N. Vass) 180–182
Meniscectomy in soldiers; review of cases discharged from an army convalescent depot. (J. J. R. Duthie & J. G. Macleod) 182–183

1 : 12/2/44

Anærobic infections in Tripolitania and Tunisia. (D. M. MacLennan) 203–207
Supplementary feeding in pregnancy. (M. I. Balfour) 208–211
Adolescent kyphosis. (T. J. B. A. MacGowan) 211–214
Rhesus antibody in Rh-positive mother causing hæmolytic disease of newborn. (A. J. McCall, R. R. Race & G. L. Taylor) 214–215
Fitting industry to human needs: the contribution of medicine to industrial well-being. (T. A. Lloyd Davies) 223–225

Medical Officer

71 : 8/1/44

Growth of infants in the first year of life: a comparison between war years as compared with pre-war years in the town of Glossop. (E. Lewis-Faning & E. H. M. Milligan) 13–15

71 : 15/1/44

Growth of infants in the first year of life: a comparison between war years as compared with pre-war years in the town of Glossop. (E. Lewis-Faning & E. H. M. Milligan) 21–23

71 : 22/1/44

Growth of infants in the first year of life: a comparison between war years as compared with pre-war years in the town of Glossop. (E. Lewis-Faning & E. H. M. Milligan) 29–31

ERRATUM: VOL. 2, NO. 1

In line 17 of *BMB* **239** the number 26 was accidentally inserted and should be disregarded

---

British Medical Bulletin is published by the British Council. One volume will appear each year, and each volume will contain a maximum of 12 *parts, issued at approximately monthly intervals. The object of the Bulletin is to provide a guide to medical work in Britain. Requests for further information on any of the investigations reported, or for general information, bibliographies, and particulars of medical books and journals published in Britain should be addressed to the British Council, Medical Department,* 3 *Hanover Street, London, W.*1, *England*

Printed by Spottiswoode, Ballantyne and Co. Ltd., Colchester, London and Eton